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HILL COUNTRY SHEEP-FARMING IN THE NORTH ISLAND.

AN ECONOMIC STUDY OF EAST COAST FARMS.

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IT is intended in this article to discuss on broad lines some of the features of hill country sheep-farming in the North Island under the following headings: (1) Stocking system, (2) disposal of stock, (3) gross returns from the several commodities, (4) expenses of working and management, (5) capital position, (6) seasonal price fluctuations and results.

The district in which the farms under review are situated is broadly known as the "East Coast"; the counties concerned are Matakaoa, Waiapu, Waikohu, Uawa, Cook, and Wairoa. This area is looked upon as one of the favoured hill-country sheep districts of New Zealand. The nature of land is fairly uniform throughout, as is illustrated by the type of pasture which it carries. It has all at one time carried English grasses, and although to some extent—and in some localities more than in others—the better type of pasture still persists, native grass has become the dominant feature over the greater portion and is steadily increasing. In seasons of plentiful and well-distributed rainfall, rye-grass, cocksfoot, and white clover increase the proportion of high-class fodder available. It is evident that these grasses could be rejuvenated by systematic top-dressing, but it is questionable whether this class of country can be held economically on a large scale by the use of artificial fertilizers. The use of heavy cattle, which is an integral part of the farm management of this land, tends to hold the better grasses and to clean up the country generally. Despite the skill with which this living implement is used, however, cattle alone will not permanently hold rye-grass on country from which fertility is being constantly removed in the form of meat and wool.

The whole of the hill country of this favoured district, in company with the rest of the hill country of New Zealand, is going through, or has gone through, what is commonly known as a "deterioration

stage from an English grass sward to a mixture of English and native grasses where eventually danthonia will be the dominant feature of the pasture association.

The information used in this study was supplied by the owners concerned in the form of copies of the station accounts kept by competent accountants. A considerable number of the farms were visited personally, the whole district being very familiar to the writer. The accounts studied cover a period of five seasons—namely, from 1921–22 to 1925–26. These years represent a good range of price conditions, including as they do two bad seasons, one medium season, and two high-price seasons. Thus the average of the whole gives a fair indication of the merits of the hill-country sheep industry in this district.

STOCKING SYSTEM.

Sheep.—The system of stocking adopted on farms of the type under discussion is of a uniform nature, fluctuating in the proportion of stock classes carried according to the state of pastures predominating. It is a generally accepted fact that the greater the proportion of ewes in the flock the more profitable the farm is likely to be. Table 1 indicates the ability of the farmer to sell a greater proportion of his lambs as fats and stores on land of high ewe-capacity. The percentage wintered as hoggets decreases, and practically the whole of the wethers are cleared as two-tooths.

Table 1.—Farms grouped according to Ewes wintered, showing Percentage of Stock Classes.

1	2	3	4	5	6	7	8	9
Ewe Range.	Number of Farms.	Ewes	Hoggets.	Wethers.	Rams.	Total.	Sheep Class.	Ratio of Classes to Ewes (Average).
Per Cent.		Per Cent.	Per Cent.	Per Cent.	Per Cent	Per Cent.		
41/50 ..	4	47·76	35·16	15·80	1·28	100·00	Ewes ..	100·00
51/60 ..	17	55·27	35·80	7·52	1·41	100·00	Hoggets	63·39
61/70 ..	2	63·82	31·57	2·22	2·39	100·00	Wethers	16·72
71/80 ..	1	71·35	26·07	0·67	1·91	100·00	Rams	2·75
Average	24	55·48	34·42	8·56	1·54	100·00	Total	182·86

Undoubtedly the surplus available for interest after working-expenses and management salary are met is greater per unit of area than is the case on low ewe-capacity land. The group of four farms of 41/50 per cent. ewe-capacity average an interest surplus of £47·13 per 100 acres. For the group of seventeen farms of 51/60 per cent. ewe-capacity the surplus rises to £60·21 per 100 acres. The remaining two groups do not represent sufficient farms to be taken as reliable, but they do show slight advances over the lower ewe-intensity groups.

Cattle.—It is not to be expected that the number of cattle carried will show a correlation with returns, as the variations between farms hide any effect that cattle may have. To gauge this effect it would be necessary to have strictly comparable farms on some of which cattle were not kept. Over the twenty-four farms cattle-intensity

varies from 1 to 29 to 1 to 7 sheep, with an average of 1 to 12. Of the total cattle kept, 44 per cent. represents breeding-cows, while the remainder represents mixed classes of varying ages.

Disposal of Stock.

The exact numbers of different classes of stock disposed of are difficult to obtain over a range of farms, as the data are not sufficiently detailed in the farmers' accounts. From the information available the sales per hundred sheep wintered—allowing for a 7 per cent. death-rate and 4 per cent. killed for station consumption—are approximately as follows :—

Class.	Number.
Ewes (cull two-tooth or sound full-mouth)	10·0
Lambs	7·6
Hoggets (two-tooth or as rising two-tooth)	11·9
Wethers (rising four- or six-tooth)	6·5
Total	36·0

As previously indicated, sheep-sales are likely to fluctuate above or below this average according to the proportion of ewes carried. In addition to sheep-sales during normal seasons, an average of approximately two cattle beasts are sold per hundred sheep wintered.

Gross Returns.

In studying production and costs on sheep-farms of this type the best bases of comparison are area of holdings and total sheep carried, as the fluctuations in returns and working-expenses are influenced by these factors rather than by intensity of carrying-capacity. In the case of the twenty-four farms under consideration area and size of flock give the same grouping of farms. Therefore in the following tabulations area grouping only has been used.

Owing mainly to the fact that small farms are as a rule of better quality and may be given close supervision with relative ease, carrying-capacity increases as the area of the average farm decreases, as shown in Table 2 (col. 4). On an area basis the number of

Table 2.—Farms grouped according to Area, showing Stock, &c.

1	2	Per 100 Acres.			Per 1,000 Sheep.	
Area Range.	Number of Farms.	3 Average Area of Farms.	4 Sheep wintered.	5 Cattle wintered.	6 Area.	7 Cattle wintered.
Acres.		Acres.			Acres.	
5,000/14,999 ..	8	9,921	133·46	13·97	749	104·7
2,000/4,999 ..	8	3,279	141·67	12·00	706	84·7
300/1,999 ..	8	1,281	157·90	13·19	633	83·5

cattle carried does not vary considerably (col. 5), but when considered in relation to sheep carried the number decreases with area or as sheep-carrying capacity increases (col. 7).

The reflection of carrying-capacity increase on farms of smaller areas is apparent in returns from sheep and wool (Table 3, A, cols. 4 and 6). When considered on the basis of one thousand sheep, total returns show an increased production per sheep unit, the only commodity showing a decreasing tendency being cattle.

Table 3.—Farms grouped according to Area, showing Gross Returns.

A = per 100 acres; B = per 1,000 sheep.

1	2	3	4	5	6	7	8	9
—	Area Range	Number of Farms.	Sheep.	Cattle.	Wool.	Sundry.	Total.	Area per 1,000 Sheep.
	Acres		£	£	£	£	£	Acres.
A	5,000/14,999	8	44·20	11·90	55·40	0·90	112·40	..
	2,000/4,999	8	57·54	10·59	54·93	1·20	124·26	..
	300/1,999	8	60·12	10·29	69·86	1·59	141·86	..
B	5,000/14,999	8	331·05	89·13	414·95	6·74	841·87	749
	2,000/4,999	8	406·23	74·77	387·80	8·47	877·27	706
	300/1,999	8	380·56	65·14	442·21	10·06	897·97	633

It will be seen that on farms of this type the returns from wool are of great importance, being responsible for almost 50 per cent. of the total gross income. As time goes on, and pasture deterioration makes itself more acutely felt, wool is likely to occupy an even more important position than it does at present. This being the case, it is imperative that every effort be made to produce a commodity of even quality likely to realize the highest price compatible with farm-management conditions prevailing on hill country where fat lamb and mutton ceases to be the major consideration. The percentage of gross returns represented by each commodity is shown in Table 4.

Table 4.—Farms grouped according to Area, showing Percentage of Gross Returns contributed by Commodities specified.

1	2	3	4	5	6	7
Area Range.	Number of Farms.	Sheep.	Cattle.	Wool.	Sundry.	Total.
Acres.		Per Cent	Per Cent.	Per Cent.	Per Cent.	Per Cent.
5,000/14,999	8	39·33	10·59	49·28	0·80	100·00
2,000/4,999	8	46·31	8·52	44·21	0·96	100·00
300/1,999	8	42·38	7·25	49·25	1·12	100·00

Expenses of Production.

It is to be expected that working-costs should fluctuate, no matter on what base they are considered. Especially is this the case for repairs and maintenance and sundry expenses.

Although small farms give the greatest gross return, both for a given area and for sheep, the advantage thus gained is, under the conditions of analysis used, lost in the cost of working such areas. It will be seen from Table 5 that, with the exception of rates, all costs tend to increase as the area decreases, resulting in a total cost

Table 5.—Farms grouped according to Area, showing Working-expenses.

A = per 100 acres; B = per 1,000 sheep.

1	2	3	4	5	6	7	8	9	10
—	Area Range.	Number of Farms.	Rates.	Shearing.	Stores	Repairs and Maintenance.	Wages and Salary.	Sundry.	Total.
	Acres.		£	£	£	£	£	£	£
A	5,000/14,999	8	7·00	4·70	4·00	5·77	15·33	9·53	46·33
	2,000/4,999	8	6·12	5·57	6·15	4·77	22·02	13·00	57·63
	300/1,999	8	6·53	5·59	8·42	8·53	27·02	13·97	70·06
B	5,000/14,999	8	52·43	35·20	29·96	43·22	114·82	71·38	347·01
	2,000/4,999	8	43·21	39·32	43·42	33·67	155·46	91·78	406·86
	300/1,999	8	41·33	37·91	53·29	54·02	171·03	85·89	443·47

considerably higher than in the first group. This to a great extent is due to the salary standard allowed, and will be discussed at a later stage.

The increased cost of working and management is clearly shown in Table 6. When total cost per sheep is interpreted in capital represented, the care which must be taken in buying land is indicated. The earning-value of land does not increase proportionately with carrying-capacity if the area is small and the number of sheep to be carried is low. In the case of high-capacity land in large areas this point is not so important.

Table 6.—Farms grouped according to Area, showing Expenses and Capital represented per Sheep on a 7-per-cent. Basis

Classification of Expense.	15,000/6,000 Acres.		5,000/2,000 Acres.		1,999/300 Acres.	
	Per Sheep.	Capital represented.	Per Sheep.	Capital represented.	Per Sheep.	Capital represented.
1	2	3	4	5	6	7
	s. d.	£ s. d.	s. d.	£ s d.	s. d.	£ s. d.
Rates	1 0½	0 14 5¼	0 10¼	0 12 2	0 9¾	0 11 5
Shearing	0 8½	0 10 2½	0 9½	0 11 3	0 9	0 10 11
Stores	0 7¼	0 8 8¼	0 10½	0 12 6	1 0¾	0 15 1
Repairs and maintenance	0 10¼	0 12 5½	0 8	0 9 7¼	1 1	0 15 8
Wages and salaries ..	2 3½	1 12 10¾	3 1¼	2 4 6	3 5½	2 9 0¼
Sundry	1 5¼	1 0 5¾	1 10	1 6 2½	1 8½	1 4 7¼
Total ..	6 11¼	4 19 1¾	8 1½	5 16 2¾	8 10½	6 6 8½

Rates.—Local bodies' rates is the only item of expense which shows uniformity of decline in sympathy with area. The reason for this is not clear. As the smaller farms have a higher carrying-capacity per acre, it appears at first glance that large holdings are carrying an undue proportion of local-body taxation. From the economic viewpoint the position is sound, as the owner's living surplus is materially

lower after working-expenses and interest have been paid. The variation in rates is from 1s. $0\frac{1}{2}$d. to $9\frac{3}{4}$d. per sheep (cols. 2, 4, 6, Table 6). The capital represented by rates on a 7-per-cent. capitalization is shown in cols. 3, 5, 7. Local-body rates represent approximately 10 per cent. of the total working-expenses.

Shearing.—Shearing-costs cover all labour employed expressly for shearing, and the keep of the extra staff. In addition to these expenses there are items such as wool-packs, twine, marking-ink, oil and benzine, repairs to machinery, &c., which may justly be charged to shearing, but as these items are mixed with "Sundry" and "Repairs and maintenance" their cost cannot be correctly gauged. The tendency is for shearing-costs to rise as the size of the farm decreases. This is to be expected, as loss of time through bad weather, time taken to get started, and in moving, becomes heavy where small flocks are kept. This tendency is counterbalanced by the fact that on very small farms much of the work is done by the owner, otherwise the rise in cost per sheep would be more noticeable. The cost per sheep and the capitalization of cost is shown in Table 6. Shearing-costs represent approximately 9·4 per cent. of the total working-expenses.

Stores.—This item includes all station kitchen stores and meat, plus an allowance for stores consumed by the manager. Where no manager is employed an allowance has been made equal to that allowed for stations where a manager is kept. Where the owner lives on the station and still employs a manager household stores for the family have been excluded. This is one of the items of expense which shows considerable increase, on a per-sheep basis, as area decreases (from $7\frac{1}{4}$d. in col. 2 to 1s. $0\frac{3}{4}$d. in col. 6). When capitalized this increase becomes very apparent. On the average, stores account for approximately 10·5 per cent. of the total expenses.

Repairs and Maintenance.—Repairs and maintenance are naturally a fluctuating expense, including as they do cost of fencing and repairs, scrub-cutting, grass-seed and sowing, and general repair work of all descriptions. These expenses also fluctuate from year to year and more on some farms than on others, being to some extent controlled by the state of prices ruling for primary products. They account on the average for approximately 11 per cent. of the total expenses.

Wages and Salary.—As previously indicated, the question of management reward presents difficulties. Whole-time managers are employed on 50 per cent. of the farms, the others being managed by the owners. The actual cost of labour on those farms under a manager is higher than is the case on owner-managed farms. Especially is this the case on small farms of two thousand sheep or less where very little outside labour is employed. Where small farms are run by hired labour (the owner not living on the farm) the cost per sheep is high, as is to be expected. The larger the flock the greater the scope for efficient labour-management.

For the purpose of tabulation it is essential that all farms be debited with labour costs. To effect an equal allocation the actual management salary paid has been omitted wherever it occurs, and a salary allotted according to the number of sheep wintered. It is not

suggested that the amount allowed represents the farmer's idea of a reasonable living-wage in every case. It must be recognized that on small flocks the management surplus will be low, and probably affords but an inferior living standard for the owner and family. At the same time the amount allowed is heavier per sheep on small farms than it is on large areas, and thus reflects the economic effect of labour costs on small holdings. It will be seen from Table 6 that on the standard of management allowed the cost of wages and labour per sheep increases from 2s. 3½d. to 3s 5½d., thus stressing the undue weight of management on small flocks. This is a most important feature to remember in considering small sheep holdings of this type. If the whole of the work is done by the owner, flocks of under one thousand sheep cannot afford a high management salary The fact of the comparatively high prices realized for small farms but accentuates the difficulty. Wages and salary on this basis represent approximately 37·1 per cent. of the total working-expenses. The scale of management salary allowed is as follows :—

	£
300 to 1,000 sheep	125
For every 500 sheep up to 5,000, £25 additional, or £325 for 5,000 sheep.	
5,000 to 6,000 sheep	350
6,000 to 7,000 sheep	375
7,000 to 10,000 sheep	400
10,000 to 15,000 sheep	450

Sundry Expenses.—This item includes insurance, shoeing, cartage, depreciation, oil, benzine, &c., and is a fluctuating amount representing an average of approximately 21 per cent. of the total working-expenses.

Interest and Profit.

Although the farm accounts analysed show a capital account they are not all computed on the same base, and are therefore not comparable. To establish an equable comparison between groups it is essential that interest charges be standardized on a uniform scale. In some instances the land is leased, and stock, plant, and improvements only are shown in the capital account. In other cases the mortgages shown are too heavy, which, when taken in conjunction with private capital, gives a capital investment considerably above the earning-limits of the land. The practice of placing profits to capital has in some accounts raised the personal capital above that which is actually employed in farming operations. For the purpose of establishing a uniform interest charge, total stock units carried have been taken as the base and capitalized at £4 per stock unit (*i.e.*, total sheep plus cattle, one cattle beast being taken as equivalent to seven sheep). This method reflects as nearly as possible the carrying-capacity of each farm, and approximates a value per sheep of £5 for land and improvements. By adopting this method a profit or loss is shown which becomes comparable between groups of farms. It may be considered that the scale of capitalization used is not high enough. If so it may be altered to suit individual cases, but the fact remains that even on this figure the surplus as profit is very small indeed, and the average farm cannot show reasonable interest on a higher capitalization.

When capital computed on this basis is charged with interest at 7 per cent. the position is as follows :—

Table 7.—Farms arranged according to Area, showing Interest and Profit per Thousand Sheep.

1 Area Range of Groups.	2 Number of Farms.	3 Gross Returns.	4 Working-expenses and Management.	5 Interest on Capital at 7 per Cent.	6 Profit.	7 Land-tax.
Acres.		£	£	£	£	£
5,000/14,999	8	841·87	347·01	484·97	9·89	62·64
2,000/4,999	8	877·27	406·86	446·09	24·32	13·17
300/1,999	8	897·97	443·47	443·10	11·40	5·20

It will be seen from Table 7 that profit per thousand sheep wintered is greatest on farms of medium size (col. 6). Up to the present stage land-tax has been ignored, but, as shown in column 7, its importance is clearly indicated.

The capital position is shown from a different angle in Table 8.

Table 8.—Farms grouped according to Area, showing Earning-capacity per Sheep wintered and per Acre.

1 Area Range of Groups.	2 Number of Farms.	3 Interest Surplus.	4 Total Capital represented at 7 per Cent.	5 Capital Value of Land and Improvements.	6 Value of Land and Improvements per Sheep.*	7 Value of Land and Improvements per Acre.*	8 Sheep wintered per Acre.†
Acres.		£	£	£	£ s. d.	£ s. d.	
5,000/14,999	8	494·86	7,069	5,346	5 6 9	7 2 9	1·33
2,000/4,999	8	470·41	6,720	5,097	5 1 11	7 4 5	1·41
300/1,999	8	454·50	6,493	4,876	4 17 4	7 14 1	1·57

* Unweighted. † Weighted.

Interest surplus shown in col. 3 represents the difference between gross receipts and working management expenses for the respective groups. Total capital (col. 4) represents the interest surplus capitalized at 7 per cent. From this amount is subtracted the value of stock and plant, which leaves net value of land and improvements on which 7 per cent. interest has been earned after working-expenses have been met and a standard management salary allowed. Cols. 6 and 7 show this amount interpreted per sheep and per acre. Once more the effect of added cost per sheep in the case of small flocks is shown.

The percentage increases in value of land and improvements per acre for the three groups, taking the first as 100, are 101·4 and 107·7 respectively. The increases in sheep carried for the same groups are 106 and 118 per cent., showing that the value of land (provided the standard of management reward be considered reasonable) does not increase in a uniform ratio with carrying-capacity.

Seasonal Fluctuations and Results.

The foregoing analysis illustrates the average position on sheep-farms of this nature over a period of five years. Taking the long-time

view, the farmer is able to earn a living-wage varying in extent according to the size of his business, and if the capitalization of his enterprise is reasonable then he may earn in addition fair interest on his own money after meeting his mortgage liabilities. As indicated in previous tables, the rate of interest earned on his personal capital depends entirely on his equity in the farm and on total capitalization. If 7 per cent. is considered a reasonable amount to expect, then, on the average, capitalization per sheep or per acre must be considerably lower than that claimed or expected at the present time.

During years of high prices one often hears of the profits from large pastoral properties. Undoubtedly, on large holdings with low capitalization owing to the process by which such land has come into the possession of its present owners, the profit on the actual capital involved may be very high in good seasons. Whether profit from holdings of this nature should be considered on the actual outlay or on the capital which the business represents on the market at the present day is a subject which need not be discussed here.

Farming of all types is very subject to violent fluctuations in cash turnover. These fluctuations may be caused by seasonal variation affecting the volume of production, but the most serious cause is price-variations from season to season. Dairy-farming is perhaps the most stabilized branch of our primary industries, and the position there can be studied with comparatively reliable results on one season's returns. The individual farm units are small, and the fluctuations in total receipts have not been great for some years past.

In sheep-farming or mixed farming, where sales are of a more diversified type, price-variations may affect one or all of the products. It is therefore impossible to judge sheep-farming profits on one season only. To illustrate this point the gross yearly earnings of different commodities on the twenty-four farms here reviewed are shown separately for each season in Table 9.

Table 9.—Seasonal Fluctuations of Gross Returns per 1,000 Sheep wintered (Average of Twenty-four Farms).

1	2	3	4	5	6	7	8
Season.	Total Sheep wintered.	Sheep.	Cattle.	Wool.	Sundry.	Total.	Fluctuation from Average.
		£	£	£	£	£	Per Cent.
1921–22 ..	151,269	260	58	172	11	501	−42·01
1922–23 ..	152,279	443	75	365	7	890	+ 3·01
1923–24 ..	151,596	365	92	631	7	1,095	+26·73
1924–25 ..	164,579	449	145	556	7	1,157	+33·91
1925–26 ..	164,674	279	52	341	7	677	−21·64
Average	..	357	84	415	8	864	..

Fortunately seasonal price-fluctuation in one commodity is not always reflected in the others, which tends towards levelling of total receipts. In the two bad seasons low prices for sheep and wool have combined to aggravate the position. It will be seen in col. 8 that variation from the average is of such a magnitude that the effect of bad seasons must be reflected in the better years, as interest charges and maintenance expenses naturally accumulate.

Although expenses are to some extent curtailed during bad seasons, the fluctuation in working and management costs cannot be synchronized with receipts. In Table 10 interest and profit surplus is shown for each year.

Table 10.—Seasonal Fluctuations of Capital Position for 1,000 Sheep wintered (Average of Twenty-four Farms.)

1	2	3	4	5	6	7
Season.	Gross Returns	Working-expenses and Management.	Fluctuation of Working-expenses, &c.	Interest and Profit Surplus	Column 5 capitalized at 7 per Cent.	Total Capital represented per Sheep wintered
	£	£	Per Cent.	£	£	£ s. d
1921–22 ..	501	328	−12·30	173	2,472	2 9 5¼
1922–23 ..	890	343	− 8·29	547	7,814	7 16 3½
1923–24 ..	1,095	397	+ 6·15	698	9,972	9 19 5¼
1924–25 ..	1,157	403	+ 7·75	754	10,771	10 15 5
1925–26 ..	677	399	+ 6·69	278	3,971	3 19 5

Although working-expenses show fluctuations, the range is not great on either side of the average. The effect of seasonal price-variations is shown clearly in col. 7, where the total capital on which 7 per cent. interest is earned is interpreted in terms of sheep. There are still two items to be deducted from this amount—the value of stock and plant, and land-tax—before the real value of land and improvements can be shown on the basis which interests the farmer. This is done in Table 11.

Table 11.—Seasonal Fluctuations of Capital Position per 1,000 Sheep and per Sheep wintered (Average of Twenty-four Farms).

1	2	3	4	5	6	7
Season.	Interest and Profit Surplus.	Land-tax.	Interest on Stock and Plant at 7 per Cent.	Net Interest and Profit.	Column 5 capitalized at 7 per Cent.	Earning Value of Land and Improvements per Sheep.
	£	£	£	£	£	£ s. d.
1921–22 ..	173	56·96	115·50	0·54	7	0 0 1¾
1922–23 ..	547	47·03	115·50	384·47	5,492	5 9 10
1923–24 ..	698	43·86	115·50	538·64	7,695	7 13 10¾
1924–25 ..	754	40·14	115·50	598·36	8,584	8 10 11½
1925–26 ..	278	41·42	115·50	121·08	1,729	1 14 7

When all the farmer's expenses are taken into consideration, seasonal price-variations so affect the position that in very bad years the whole of the interest on borrowed capital has to be met from reserve or by bank overdraft. It is quite clear that, taking the good years with the bad, it is not easy for him to make a reasonable average interest on a moderate capitalization; and when land has been bought at a high price sheep-farming of this nature may become a hazardous occupation financially.

The writer wishes to record his appreciation of the co-operation of those farmers who placed their accounts at his disposal for the purpose of this analysis.

PIG RECORDING.

FIRST REPORT ON WORK OF WAIKATO, MANAWATU, AND MID-CANTERBURY GROUPS, SEASON 1928–29.

Introduction.

THIS report is issued by the Pig Industry Research Committee of the Council of Scientific and Industrial Research, and has been prepared from data and conclusions furnished by the three directing officers of the recording groups—Mr. M. J. Scott, Canterbury Agricultural College; Professor W. Riddet, Massey Agricultural College; and Mr. C. M. Hume, then of the New Zealand Co-operative Herd Testing Association, Hamilton.

The renewed interest in the pig industry of New Zealand apparent during the years immediately preceding 1928 gave possibilities of considerable expansion being made in this branch of production, and the need for information which might assist to guide this expansion into right channels led the Department of Scientific and Industrial Research to inaugurate, during 1928, pig-recording investigations in various districts of the Dominion.

Canterbury Agricultural College, Lincoln, had for some time previously been engaged upon experiments connected with the feeding and management of pigs, and had pioneered the way in pig-industry research. The results of some of this research had been published already in bulletin form ("Pig Production and Results of Feeding Trials," M. J. Scott, B.A., B.Sc., A.I.C., Bulletin No. 2, Department of Scientific and Industrial Research), and these results indicated that further investigatory work dealing with the pig industry was warranted.

During 1928 the Government signified its intention of helping the industry by providing a subsidy on the export of pork, and its interest in the pig-recording investigations was shown by a grant of £1,050 for their promotion. With this grant the Department of Scientific and Industrial Research was enabled to establish three pig-recording groups in the Mid-Canterbury, Manawatu, and Waikato districts. These districts were selected on account of their being typical of different feed conditions prevailing throughout the pig-raising districts of the Dominion. Trials with various pig-feeds were also inaugurated, special attention being given to the use of meat-meal and whey paste.

In the Waikato district skim-milk predominates as the pig-feed. In the Manawatu district the balance between skim-milk and whey is fairly even. In Mid-Canterbury skim milk is available generally in somewhat small supply, while quantities of cereal and grain feeds are available in generous amounts. In the Waikato and Manawatu districts, especially the former, there is a dearth of concentrated feeds, and such as are used require to be imported from the South Island and the maize-growing areas of the Poverty Bay and Bay of Plenty districts.

In view of the potentialities of greater utilization of the excellent pastures in the dairy districts, more attention should be devoted to the

possibilities of securing from them a better-balanced diet, which, used with the supplies of dairy by-products, would in some measure make compensation for the present dearth of cereals.

Economic factors in all districts necessitate the feeding of pigs on ill-balanced rations, whatever feed is available in greatest amount being fed to excess in all cases. Furthermore, both in the Waikato and in the Manawatu areas, the disposal of these surplus dairy by-products—whey and skim-milk—presents a problem on every farm. If discharged into drains or streams the consequent pollution quickly reacts on the farmers themselves. The only practical means, therefore, of disposing of these products is by pigs, and this very often in the not too sanguine hope that these will bring in some return. Statistics show that the pig industry in New Zealand is more closely associated with the dairying industry than with any other, and this association is very largely accounted for by the reason just mentioned.

During the last ten years methods of improving live-stock production have received considerable attention, with the result that " selection on performance " has come to be recognized as the surest way of making improvement. Whereas in the past selection for breeding purposes has been based on pedigree only, it is now clearly realized that unless purebred stock are also stock of high productivity their pedigree can be of little use. Breed associations should decline registration to animals which characteristically produce small litters. Performance has to be tacked on to pedigree, and the only way of evaluating performance is by keeping records of growth-rate and of production-costs. By doing so all the poor performers can be eliminated, and ultimately only the proven high producers will be used. To this end various systems of pig recording have been instituted in Denmark, Sweden, Norway, England, and Canada, and, while there are differences in the details from country to country, they all agree in collecting data concerning (1) number of piglets farrowed per litter, (2) litter weights and numbers per litter at four and eight weeks old, (3) details of feeding where possible, (4) details of housing, management, and care, (5) breed of sow and of boar.

To this end a recording officer goes round the locality and enrols those farmers who are willing to co-operate. Once contact is established the farmer keeps the recording officer informed by telephone or letter of dates of farrowing of sows. At the officer's convenience these pigs are earmarked and weighed at somewhere between three and five weeks old, and again between seven and nine weeks. From these weights those at four weeks and at eight weeks can be deduced. As a result of weekly weighings of about fifty litters at Lincoln College during eighteen months, it was found that little or no error is introduced by adjusting the weight in this way.

The three recording officers appointed in 1928 worked under the ægis of Canterbury Agricultural College, Massey Agricultural College, and the Waikato Group Herd Testing Association. They were supplied with means for weighing pigs, with travelling-allowances, and with standardized recording forms on which data relating to each farm and each pig were entered.

In addition to weighing litters, the pig-recording officers collected what information was available regarding breeding, feeding, systems of management, and mortality, and weighed as many fattening pigs as possible in order to get information on the normal rate of growth under varying conditions of management. It was not possible to follow the weights of all individual pigs till time of disposal, as farmers availed themselves of any opportunities of sale that arose, and accordingly in only a few cases were the final weights recorded.

The data so collected were partly worked up by the recording officers and partly by Mr. Scott, Professor Riddet, and Mr. Hume. Quarterly reports of the data were circulated between these three gentlemen, and thereby each was enabled to follow the results being secured in districts other than his own, and to set out a standardized scheme whereby comparisons between districts were possible.

At the outset of the work the recording officers visited those farmers who indicated their willingness to join in the scheme, an endeavour being made to secure, within as near a radius as possible, a total of between two and three hundred sows for recording purposes.

In the Manawatu district the local Pig-breeders' Federation showed much interest in the movement and used their endeavours to induce farmers to participate in the work. In other districts the interest displayed by pig-breeders was laudable, but during the course of the season a good many who at the beginning had indicated their readiness to participate in the scheme found themselves unable to do so. Pressure of work on the farm at the time of the recording officer's visit was often responsible for a farmer dropping out. The recording officer was almost entirely dependent upon the active assistance of the farmer himself in order to conduct the weighing expeditiously. At such seasons as haymaking time this assistance was not forthcoming. Again, in some instances farmers were so disappointed with the litters of young pigs farrowed that they were reluctant to have these figures recorded. The sale of young pigs as weaners was also responsible for a number of breaks in the records.

On many farms the facilities for yarding and weighing the pigs were poor. Recording of pigs is by its very nature somewhat difficult and arduous work, and during wet weather the actual labour of weighing became a task which most were reluctant to undertake. For these reasons there was some defection of farmers as the season progressed, a trouble which was common to all the districts.

Table 1.—Summary of Completed Records.

District.	Number of Farms.	Number of Sows recorded.	Number of Feeding Trials conducted.
Waikato	37	245	About 40
Manawatu	37	121	..
Mid-Canterbury	37	126	20

Table 2 summarizes the data secured in regard to litter-size and litter-weight at various ages in the three districts.

Table 2.—Litter Numbers and Weights at Various Ages.

District.	Pigs born per Litter.	Litter-weight at Four Weeks	Pigs per Litter at Four Weeks.	Weight per Piglet at Four Weeks.	Litter-weight at Eight Weeks.	Pigs per Litter at Eight Weeks	Weight per Piglet at Eight Weeks.
		lb		lb.	lb.		lb.
Waikato ..	..	97·7	7·40	13·2	207	7·4	28
Manawatu ..	9·1	106·5	7·3	14·7	229	7·3	31·5
Mid-Canterbury	10·1	109·0	8·00	13·6	230	7·95	29

Points from Tabulated Data.

MORTALITY.

Columns 1 and 3 of Table 2 show that there is a 20-per-cent. mortality occurring from birth to weaning date. Most of the deaths occurred within two to three days of birth, and where deaths are low they could be prevented by more care on the part of the owner. There is considerable ground for the belief that mortality is due to faulty feeding and management prior to birth, and that this point is worthy of closer consideration from a nutritional aspect. Proper feeding and care of the sow prior to farrowing and due attention to sanitation are powerful influences tending to reduce the mortality which occurs among very young pigs.

BREED INFLUENCES.

By the average farmer the influence of breed upon mortality-rate and litter-weight is given greater importance than is accorded to individuality. Tables 3 and 4 set out the relation of the breed to litter-weight at eight weeks. The averages would appear to indicate advantages in favour of the two bacon breeds, Large Black and Large White, but the smaller numbers of these recorded give less significance

Table 3.—Litter-weights at Eight Weeks from Various Breeds of Sows.

District.	Berkshire.	Tamworth.	Devon.	Large White.	Middle White.	Tamworth-Berkshire Cross.
	lb.	lb.	lb.	lb.	lb.	lb.
Waikato	213·8	216·3	..	299·9	141·8	198
Manawatu	213	219	277	263	231	217
Mid-Canterbury ..	225	..	300	..	..	220

Table 4.—Litter-weights at Eight Weeks from Various Breeds of Boars.

District.	Berkshire.	Tamworth.	Devon.	Large White.	Middle White.
	lb.	lb.	lb.	lb.	lb.
Waikato	188	205·9	..	381·2	154·8
Manawatu	217	225	290	244	232
Mid-Canterbury ..	225	..	292	273	180

to the data than those of the Berkshire and Tamworth breeds, and this obscures the position considerably. It is important to appreciate that all breeds can produce good litter-weights at eight weeks old, just as in the case of dairy cows, but more influence should be attached to factors other than breed.

The comparison of all breeds together is open to the objection that this ignores the type of pig. Breeders have in the past aimed at producing pork types as opposed to bacon types, the former being plumper than the latter and accordingly more prime for slaughter as pork from 90 lb. to 130 lb. live-weight. Thus it may be stated that the larger frame of the bacon breeds is more conducive to heavy litter-weights at eight weeks. There is some evidence that such a contention is not fully justified in that bacon types can also suit the porker trade. Further experience on this point is required. Meantime it can be said that other factors appear to be more important than breed, and in a general survey of breeds the Large White and Large Black have possibly some advantages.

SIZE OF LITTER.

It is evident from Table 6 that the size of the litter does not materially affect the individual weight of piglets at eight weeks (column 4). This, then, is a point in favour of sows having large litters. The size of the

Table 5.—Size of Litter in Relation to Litter-weight and Average Weight per Piglet

Number of Pigs per Litter.	Number of Litters.			Average Litter-weight.			Average Weight per Piglet.		
	Canterbury	Waikato.	Manawatu.	Canterbury.	Waikato.	Manawatu.	Canterbury.	Waikato.	Manawatu.
				lb.	lb.	lb.	lb	lb.	lb.
3 ..	..	..	2	..	..	102	..	..	34
4 ..	..	..	8	..	..	162	..	..	40·4
5 ..	5	25	14	185	137	164	37	27·4	32·7
6 ..	14	30	25	188	171	200	31·2	28·5	33·3
7 ..	19	43	23	203	197	228	29	28·2	32·5
8 ..	21	44	21	247	221	226	30·9	27·7	33·2
9 ..	18	27	13	258	232	283	29·4	25·8	31·4
10 ..	11	22	8	295	261	299	29·5	26·1	29·8
11 ..	5	2	6	346	367	281	31·5	33·3	25·5
12 ..	..	2	1	..	418	257	..	34·8	21·4

Table 6.—Average of all Records: Litters grouped by the "Number per Litter."

Number of Pigs per Litter.	Number of Litters.	Average Litter-weight.	Average Weight per Piglet.
		lb.	lb.
5	44	151	30·2
6	69	185	30·8
7	85	206	29·5
8	86	238	29·8
9	58	252	28·0
10	41	276	27·6
11	13	319	29·0
12	3	361	30·0

litter does very materially affect the litter-weight, as is seen from column 3. Farmers aiming at prolificacy need fear no loss in weight of piglets, provided they give attention to individuality, feeding, care, and management. The differences in the average weights per piglet appearing in column 4 are not significant, but the table shows that larger litters are not secured by sacrificing the weights of the individual piglets of which they are composed.

LITTER-WEIGHT AT EIGHT WEEKS.

Litter-weight at eight weeks of age appears to be the crux of consideration. It is related to numbers in the litter, but not alone to the question of number There can be heavy litters at eight weeks with litters of average size, just as there can be with litters of larger size. Feeding, management, and breeding no doubt all play a part. It is undoubtedly an aim well worthy of attainment to secure good litter-weight at eight weeks, and, while the present average is 225 lb., it is possible to obtain more than double this weight.

It will be seen from Table 8, column 5, that the weight per piglet increases progressively, so that the piglets in the heaviest litters are twice as heavy as those in the lighter litters. The produce of the sow is the thing that counts, and it is by increasing the weight per piglet that these can be most improved, as heavy piglets indicate good feeding, housing, and management, while the lighter ones indicate the reverse. Indeed, litter-weights provide a good index of the quality of management. The number of pigs born cannot be subsequently increased, and although this number is largely influenced by the treatment received by the sow prior to farrowing it is not entirely controlled by man, and lies largely in the power of the animal. Until the management factor is standardized the influence of heredity cannot be definitely measured. The part played by the owner in the care of the sow is of the greatest importance, and reference to Table 8 shows that the heaviest litters are about four times as good as the lightest.

It has been found as a result of the past year's work that, whatever the conditions obtaining on the farm, the litter-weight at sixteen weeks old can be forecast from the litter-weight at eight weeks old, because in general the feeding remains the same throughout in the cases reviewed.

The distribution of litter-weights at eight weeks in the three groups brings into prominence the large proportion of sows which produce litters whose eight-weeks weight is less than 200 lb., while only some 15 per cent. of all litters reach weights of 300 lb. or over at this age. This large percentage of low-weight litters is a serious economic handicap to the industry, and emphasizes the need for paying due attention to weaning weights and the factors upon which they are dependent—namely, breeding, feeding, and management.

Table 9 gives actual data on the relation of litter-weights. In general if the weight at eight weeks is multiplied by 2½ the result will be very close to the weight at sixteen weeks. Piglets weighing 20 lb. at eight weeks weigh 50 lb. at sixteen weeks, and will require feeding for another six weeks to reach pork weights. Piglets weighing 40 lb. at eight weeks weigh from 90 lb. to 100 lb. at sixteen weeks—the

Table 7.—Litter-weights at Eight Weeks old, arranged by Class Intervals of 50 lb.

Class Average.	Number of Litters.			Average Weight of Litters.			Number of Pigs per Litter.			Average Weight per Piglet.			Average Deaths per Litter.
	Waikato.	Canterbury.	Manawatu.	Waikato.	Canterbury.	Manawatu.	Waikato.	Canterbury	Manawatu	Waikato.	Canterbury	Manawatu	Manawatu.
lb.				lb.	lb.	lb.				lb	lb.	lb.	
Up to 100 ..	..	..	1	..	..	67	..	..	3·0	..	..	22·2	8·0
101–150 ..	45	10	12	128	140	127	6·5	6·8	5·5	19·7	20·8	23·1	3·2
151–200 ..	54	24	36	175	180	178	7·0	7·1	6·0	25	25·3	29·7	2·3
201–250 ..	55	26	31	234	224	224	7·8	7·7	7·9	28·7	29·1	28·1	1·4
251–300 ..	24	14	20	276	278	271	8·7	8·5	8·0	32	32·6	34·0	1·5
301–350 ..	7	11	12	331	324	318	8·4	9·1	9·3	39·3	35·7	34·6	1·3
351–400 ..	4	3	6	374	367	369	9·0	9·3	8·5	41·6	39·4	43·4	1·3
401–450 ..	3	5	1	437	429	412	9·7	10·0	9·0	45·2	42·9	45·8	1·0
451–500 ..	1	..	1	481	..	460	11·0	..	9·0	43·7	..	51·1	..
501–550 ..	1	..	1	541	..	524	12·0	..	8·0	45·1	..	65·5	..

Table 8.—Average of all Records: Litters arranged by Weights; those of similar Weights in one Group. Class Intervals of 50 lb.

Class.	Number of Litters	Number of Pigs per Litter.	Average Weight per Litter	Average Weight per Piglet.
lb.			lb.	lb.
101–150	67	6·4	129	20·2
151–200	114	6·7	176	26·3
201–250	112	7·8	223	28·8
251–300	58	8·4	274	32·6
301–350	30	9·0	323	35·9
351–400	13	9·1	369	41·0
401–450	9	9·8	429	43·9
451–500	2	10·0	..	47·0
501–550	2	10·0	..	53·2

system of feeding being almost constant throughout—and are then ready for killing (the best reach pork weights at fourteen weeks old). Conditions that produce heavy litters save nearly half the feeding-costs, or, looked at from another point of view, they increase considerably the returns from the feed available.

Table 9.—Relation of Litter-weights at Eight Weeks old to those at Sixteen Weeks old.

Records.	Litters weighing less than 250 lb. at Eight Weeks.	Litters weighing more than 250 lb. at Eight Weeks
Canterbury	257 per cent. (13 litters)	251 per cent. (16 litters)
Waikato	242 per cent. (53 litters)	241 per cent. (18 litters)

It has been found that some sows produce less than 150 lb. weight of pigs at eight weeks, while others of the same breed produce up to 400 lb. weight. This difference is, of course, not entirely attributable to the sow. The importance of getting piglets up to good weight at weaning-time—eight weeks—could not have been realized, but it has now been proved from the result of the past year's work that getting piglets up to heavy weights at eight weeks old is the key to the whole question of economic production. The relationship between litter-weight at eight and sixteen weeks old respectively forcibly demonstrates the all-important part played by management, feed, and care. These factors mask completely the animal factors of prolificacy and thrift, which alone have been too much looked to in order to bring about an improvement in production.

FEEDING.

That rational balanced feeding plays an important part is shown by Table 10.

Nursing-sows fed on ill-balanced feeds such as whey and skim-milk, from which they have to abstract all their solid nourishment after the ingestion of large volumes of liquid, give disappointing results. It was possible only in a few cases to collect sound information relating to feeding, but it appears clear that those who use various meals with dairy by-products discreetly, and who get satisfactory results,

Table 10.—Litter-weights at Eight Weeks classified by Food given to Sows while nursing. (Manawatu Records.)

Feed.	Number of Litters.	Average Number per Litter reared.	Average Weight per Litter.	Average Weight per Piglet.	Average Deaths per Litter.
			lb.	lb.	
Whey only	6	5·8	136·6	23·4	4·1
Whey and meal* ..	32	8·2	258·9	31·2	2·1
Skim-milk only ..	7	7·6	187·7	25·8	2·3
Skim-milk and meal* ..	42	6·6	226·4	33·8	1·3†
Buttermilk and meal* ..	25	6·9	223·7	32·5	1·8

* No record kept of particular meals used.
† First litters from young sows only participated in this trial.

do so at a profit. In the figures collected in the Waikato the best return amounted to £5 18s. per cow from pigs after paying for concentrates, the basic diet being skim-milk. Even the average of about £3 10s. secured on other good farms indicates the beneficial results to be derived from paying attention to details. In Canterbury, where grain was freely used, the best breeders realized a return of £4 16s. per cow, an amount rendered possible largely by the copious supplies of cheap grain. It is unfortunate that our national supplies of skim-milk and whey on the one hand and cereals on the other are so widely separated by distance. The great bulk of New Zealand pig-feed consists of dairy by-products. In other countries 6 lb. of milk is held to have the same feeding-value as 1 lb. of grain. Since in New Zealand grain has generally to be bought for dairy-farms its value as opposed to its cost does not enter the question, and it can be purchased only when its use renders a higher net return possible for skim-milk or whey. The results secured where whey was used as a basic diet did not, of course, approach those where skim-milk was used. Nevertheless, while the results from whey seem to be at least one-half as good as those from skim-milk, it is significant that whey could be satisfactorily and profitably fed by some breeders.

MANAGEMENT.

Tables 11 and 12 indicate the importance of management. Good pigs, careful feeding, and attentive management all play a part in returning a profit. Undue attention to any one feature has serious limitations, and the results emphasize more than ever the fallacy of the idea that the pig is only a convenient means for disposing of skim-milk and whey.

WINTER FEEDING.

An outstanding feed factor which limits economic production in every district in New Zealand is the incomplete nature of winter feed, with the resultant loss of thrift, high mortality, and long recovery period when milk comes in. Almost 50 per cent. of sows are barren for half the year because dairy by-products are unavailable and the price of other fattening-foods is not sufficiently attractive. This represents an enormous potential loss to the industry. This condition of affairs is due to some extent to the absence in the past of any cheap supply of flesh-forming feed to make up the deficiency in milk by-products. As a result of local research in pig-feeding there are now available in almost every district in New Zealand plentiful supplies of meat-meals from freezing-works at prices of about £13 a ton. With any class of winter feed (grass, roots, potatoes, artichokes, marrows, &c.) the use of ½ lb. of meat-meal per pig per day will give entirely new values to the feeds used. Where meat-meal has been used in trials during the last three years it has increased the return from these winter feeds by as much as ten times.

DISTRIBUTION OF PUREBRED PIGS.

Farmers who realized that such wide variations occurred in their litter-weights were keen to improve their stock of pigs. Accordingly some who owned crossbred and mongrel types, and who considered that pig-raising held some promise of profitable returns, took steps to

Table 11.—Data from Waikato Skim-milk Farms (showing Return per Cow from Pigs in Column 13)

(1.) Farm Reference No.	(2.) Acreage.	(3.) Number of Cows.	(4.) Butterfat produced.	(5.) Number of Calves reared.	(6.) Number of Cows to supply Milk for Calves.	(7.) Cows supplying Pigs.	(8.) Number of Sows	(9.) Farrowing-dates	(10.) Store Pigs wintered.	(11.) Gross Return from Pigs.	(12.) Cost of Concentrates.	(13.) Net Return from Pigs	(14.) General Conditions.
			lb.							£ s. d.	£ s. d.	£ s. d.	
220	75	30	5,000	15	8	22	7	Aug. to Feb.	42	135 0 0	7 10 0	5 18 0	Good houses and sties in good repair All weaners run together till put into sties to fatten
135	200	55	12,000	18	9	46	10	July to Nov.	18	225 0 0	7 0 0	4 15 0	Each sow separate pen, ¼ acre. After weaning all run together No sties. Pigs fattened in small paddock.
75	42	20	4,400	6	3	17	6	Sept. to Oct.	..	67 0 0	0 8 0	3 15 0	Two sows together on 1 acre. Sells weaners and stores
214	200	52	14,500	10	5	47	8	Sept. to Feb.	..	155 0 0	4 2 0	3 4 6	Housing fair. Sows farrow outside. All piglets run together Maize-meal.
227	150	36	12,200	9	5	31	4	Aug. to Mar.	23	156 12 0	74 8 0	2 13 0	Good sties. Farrow outside Good grass always Pollard and pig-meal.
215	113	45	14,130	10	5	40	7	June to Dec.	7	179 0 0	56 0 0	3 1 6	Sows farrow outside Well wintered. Good grass always. Barley-meal.
194	80	28	8,120	3	2	26	5	Aug. to Feb	18	60 0 0	..	2 10 8	Conditions bad All pigs run together; sold as stores and weaners
109	30	13	3,260	7	4	9	2	Aug to Mar.	..	25 8 0	2 8 0	2 12 5	Good houses in bad repair Pigs all run in one paddock.
84	50	28	7,000	5	3	25	4	July to Nov.	9	57 0 0	..	2 5 7	Sows farrow in small runs. Piglets in paddock till put in sty to fatten.
43	36	18	4.500	10	5	13	5	July to Sept.	..	30 0 0	6 8 0	1 16 0	Small pens; bad conditions; bad drainage; wet sties.

Table 12.—Data from Whey Farms (showing Return per Cow from Pigs in Column 13)

(1.) Farm Reference No.	(2.) Acreage.	(3.) Number of Cows.	(4.) Butterfat produced	(5.) Number of Calves reared.	(6.) Number of Cows to supply Milk for Calves.	(7.) Cows supplying Pigs.	(8.) Number of Sows.	(9.) Farrowing-dates.	(10.) Store Pigs wintered.	(11.) Gross Return from Pigs.	(12.) Cost of Concentrates.	(13.) Net Return per Cow from Pigs	(14.) General Conditions.
			lb.							£	£	£ s. d.	
162	106	50	15,720	7	4	46	6	May to Aug. Nov. to Feb	..	140	26	2 12 0	Sows in 4-acre paddock, good shelter. Pigs weaned on same paddock till drafted to sties to fatten. Pollard.
141	208	90	23,078	10	5	85	8	Sept., Dec. to Mar.	81	216	27	2 3 0	Run of the farm This year litters carried through, and fatten next year; abundant grass Sows poor. Pollard.
76	100	35	11,030	8	4	31	5	July to Sept	23	70	8	2 0 0	Sows farrow in one paddock; housing bad. Pigs have run of farm. Good shelter. Casein, whey, pollard, and linseed.
180	149	70	18,000	21	12	58	10	May to Oct.	28	120	12	1 15 2	Small pen for each sow; not pig proof. Houses fair. Pigs run together. Plenty of grass Fair shelter in paddock.
135	97	52	14,800	6	3	49	5	July to Dec.	10	93	7	1 15 0	Sows run together. Pigs after weaning have run on gully. Good sties, used only for fattening. Pollard and pigmeal.
232	140	50	11,750	16	8	42	8	July to Feb.	..	95	31	1 10 7	Skim-milk and whey. Good pens and sties. Pigs neglected for first six months. Green oats supplied in spring. Good pollard available.

purchase purebred sows and boars. In their purchases they were assisted by the pig-recording officer, and this aspect of his work should, with discreet handling, be productive of distinct improvements in the general quality of pigs kept.

Summary and Conclusions.

(1) Three recording groups—in the Waikato, Manawatu, and Mid-Canterbury districts respectively—made regular weighings throughout the 1928–29 season of the litters of some five hundred sows.

(2) Records of the number of piglets and their weights were made at farrowing, at four weeks and eight weeks of age. In some cases records of management and feeding were also made.

(3) The average of all litters weighed was 225 lb. at eight weeks old. Litters of five piglets gave the lowest average weight—140 lb.—while those of twelve piglets gave the highest average—418 lb. 72 per cent. of all litters weighed did not exceed 250 lb. at eight weeks.

(4) Heavy litters comprised of piglets of 40 lb. weight at weaning pay better than light ones—that is, piglets of 20 lb It has been found that whatever the piglets' weight at eight weeks it is two and a half times as great at sixteen weeks (40 lb. weaners weigh 100 lb., and 20 lb. weaners 50 lb., at sixteen weeks), the assumption being that feeding and management during the period remain consistent and show no marked variations.

(5) The management of the sow and the litter was found to be a most important factor in the production of pig meat per sow per annum.

(6) The records made so far give no reliable information regarding strain and breed influences. The predominant influences are those concerned with feeding and management. Strain and breed influences can be assessed only after several years of continuous recording.

(7) The numerical size of the litter makes no significant difference in the weights of the individual piglets.

(8) Litter-weights are a good index of the quality of pig-management.

(9) Pigs under proper conditions are capable of producing a return of up to £5 per cow where skim-milk is used as a basic diet, and about one-half this sum where whey replaces skim-milk.

(10) This return is obtained by having clean and dry housing conditions, feeding a little grain judiciously (about 6 per cent. of the total turnover), looking after sows before farrowing, giving due consideration to correct farrowing-dates, buying no store pigs, and selling only fat stock, mostly as pork. These things are the essence of profitable production. Large quantities of grain used in a haphazard manner do not provide the solution of the problem until the points detailed are attended to.

(11) Skim-milk and whey in themselves form good basic diets for pigs, but are very greatly improved by the addition of concentrates in the form of grain or meat-meals.

(12) The use of ½ lb. of meat-meal per day for sows and stores in winter would make it profitable to have two litters per year, and to carry stores through the winter on present feeds in a thriving condition that would avoid present losses and give a quick return for the early milk.

PARTURITION IN BOVINES.

SOME MALPRESENTATIONS AND HOW TO DEAL WITH THEM.

J. LYONS, Director of the Live-stock Division, Wellington.

A NUMBER of requests have been received of late that the subject of the calving of dairy cows should be dealt with afresh in the *Journal*. The present article has been written not with the idea of making all readers who are interested in the subject expert obstetricians, but rather in the hope that it may emphasize the danger of undue interference by those not qualified to undertake such work, and that it will lessen the suffering and save the lives of many members of our herds.

While any article written on parturition may be of considerable service, more especially to the trained worker, it will not in itself be sufficient to qualify the farmer as an operator. Each case presents its own difficulties, and it is only by clinical experience that such difficulties can be met and overcome. and only the few are fitted for the work. To the trained obstetrician few cases present difficulties which cannot be overcome and the fœtus delivered safely, provided that there has not been undue prior interference and that he is given the case within a reasonable time.

At this stage I would like to give a word of warning to those in attendance on such cases. The practice of laying hold of any part of the fœtus presented—usually a leg—and applying traction cannot be too strongly condemned, and it has caused the death of many valuable animals. Should the presentation be an abnormal one the calf becomes tightly jammed in the pelvic region, thus rendering delivery more difficult, and the more difficult the delivery the greater will be the source of danger to the dam. Again, even in normal presentations, where the passage is somewhat narrow and constricted, as seen in first-calving heifers, the practice of using traction when only the legs are in evidence may cause the head to be turned round, thus rendering what would otherwise have been a simple case a most difficult one. This must of necessity be so, owing to the fact that the calf is jammed into the pelvic cavity and must be dislodged therefrom, either by incision or by manipulation, before delivery can take place. The operation is also rendered more difficult by the escape of the natural fluids from the womb, for when this takes place the organ contracts on the fœtus, making any attempt at delivery still more difficult.

In all cases of delayed parturition, before pressure is applied, the attendant should insert the hand and arm and satisfy himself that the calf is in the right position. In the event of any malpresentation it should be rectified first.

The following rules should be strictly observed by those in attendance on cows experiencing difficult parturition :—

(1) The hands and arms must be thoroughly washed in an antiseptic solution. The finger-nails should be cleaned with a scrubbing-brush, so that any offensive matter adhering to them may be removed.

(2) All instruments, cords, &c., should be thoroughly sterilized before use.

(3) When the hand and arm are inserted for the purpose of finding the position of the fœtus in the womb, the operator should make up his mind as to what requires to be done and rectify any fault if possible without withdrawing the hand. The friction caused by too frequent insertion of the hand sets up inflammation.

(4) A cow should not be calved in or near dirty or unsanitary surroundings.

(5) Undue force should not be used.

(6) The animal should be fed sparingly for a few days after delivery.

(7) Secure with cords any portion of the fœtus that may be presented, so that if that portion must of necessity be pushed back it can easily be recovered again.

In normal presentations the two forelegs are presented with the head lying directly above them, the eyes being level with the knees. In this presentation the animal does not require assistance, except in cases where the calf is dead or with heifers at the first calving. Even then undue pressure should not be applied, and care should be taken to ensure that the head is coming forward with the legs.

It should be remembered, as already stated, that in a case where the calf is dead and where the membranes containing it have ruptured and allowed the fluids to escape, the womb contracts on the fœtus and renders any necessary adjustments of the limbs, head, &c., far more difficult. The same applies when an inexperienced attendant, in trying to effect delivery, ruptures the membranes and is unable to complete the work. For this reason delivery should not be undertaken by the inexperienced.

Malpresentations.

Two front Legs presented, with the Head turned back.

In this case the hand should be inserted, and by pushing the calf back the head may be manipulated into position and delivery effected by traction, keeping the head in position with the hand so that it may not return to its former position. The hand can be withdrawn when the head is well into the passage. In other circumstances it may be necessary, in order to secure the head, to place a hook in the eye-socket or the angle of the jaw in order to manipulate it forward, or a strong cord may be used attached to the lower jaw just behind the teeth.

In presentations of this kind it is sometimes found that the head has dropped between the forelegs and one leg is over the neck of the calf. If this is the case it is waste of time trying to recover the head from such a position without first removing the leg. In order to do this it is necessary to skin the leg. A knife, preferably with a hooked point, should be introduced until the calf's shoulder is reached; it should then be inserted and a straight cut made through the skin until the fetlock is reached, when a circular incision should be made round the limb and the skin separated from the bone. When enough skin has been removed to form an attachment it should be secured with a strong cord so as to hold it in position, and the remainder of the leg should be skinned with the fingers until the elbow joint is reached. A knife should then be introduced with the hand, and the muscles between the shoulder-blade and the ribs severed; meanwhile traction should be applied to the legs to facilitate severing the muscles, and

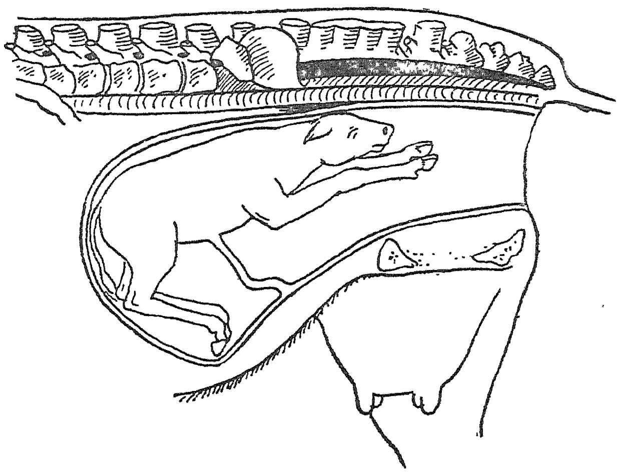

FIG I. NORMAL PRESENTATION: NOSE BETWEEN KNEES AND FORE FEET FOREMOST.

[After H. Thompson.

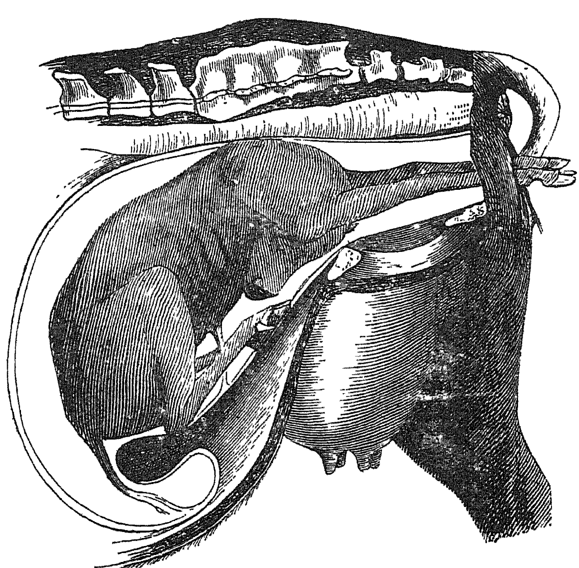

FIG. 2. FORE LEGS PRESENTED, WITH HEAD TURNED BACK.

[After G. Fleming.

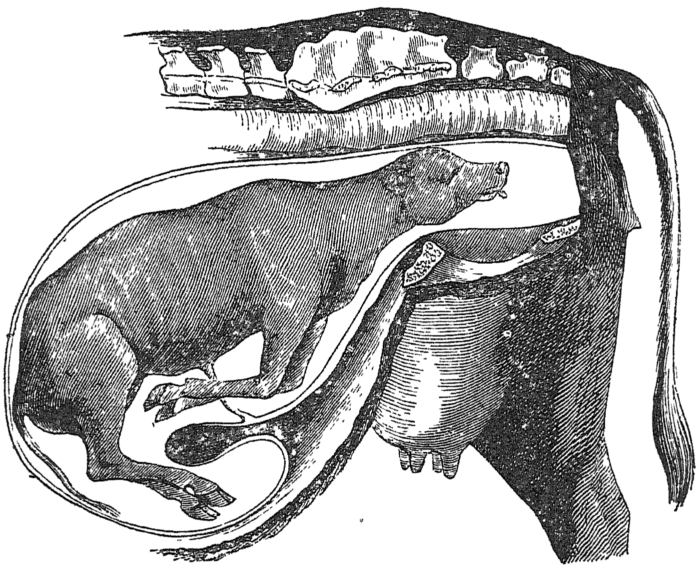

FIG. 3. HEAD PRESENTED, WITH FORE LEGS TURNED BACK.

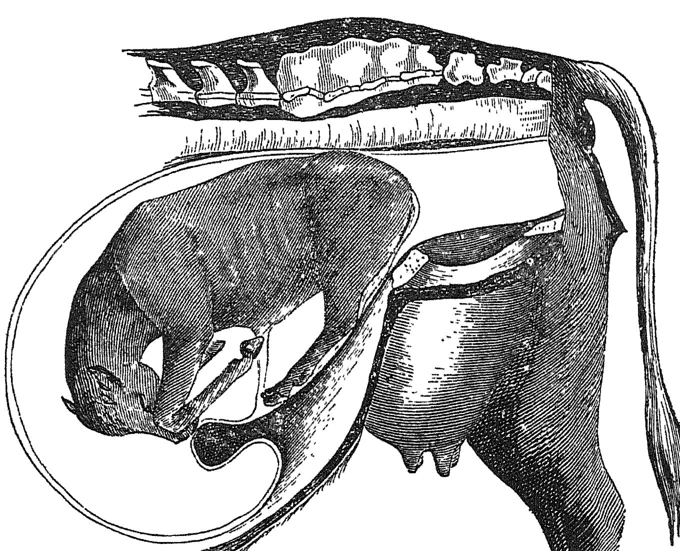

FIG. 4 BREECH PRESENTATION: HINDQUARTERS PRESENTED, WITH LEGS UNDERNEATH BODY.

[*After G. Fleming*

the leg will then come away easily. It may then be found that the head can be adjusted, but if not it will be necessary to remove the other leg in like manner. When the body is deprived of its support it drops into the cavity of the womb, allowing the head to be brought round by means of hooks or cords ; after which, by applying traction, delivery can be effected.

One or both Forelegs turned back, with Head presented.

In some presentations of this kind, more especially if the head is still in the passage, it will be found that by pressing the head back the limbs can be brought forward and delivery effected. In the majority of cases, however, before delivery can be brought about it is necessary to remove the head. In doing so the head should not be directly severed from the body, for if this is done the bones of the neck are left exposed, and, as the neck must be pushed back in order to recover the legs, in bringing the fœtus forward again the exposed bones are liable to injure the passage of the dam.

To remove the head the skin should be cut all round just above the eyes, and the remainder of the head skinned until the first joint of the neck is reached, where it can be severed and the skin tied securely over the bones and secured by a stout cord. This not only forms a protection but also affords a means of traction when required later. As indicated, the neck should then be pushed back and the legs brought forward, when the fœtus can readily be brought away.

In such cases considerable difficulty will be experienced by those not accustomed to the procedure in bringing the limbs forward. In endeavouring to do this the limb should be bent at the knee and the knee itself lifted over the brim of the pelvis, when, by pressing the bent knee towards the spinal column, it will be found that the remainder of the limb can be brought forward.

Breech presentation: Hind-quarters only presented, with legs underneath Body.

In a case of this kind it may sometimes be possible with a big roomy cow to extract the calf as presented. In the majority of cases, however, it will be necessary to manipulate the legs so as to bring them forward and deliver in the ordinary manner for a breech presentation. To accomplish this it will be necessary to push the fœtus well into the womb by means of a crutch, and then to work the leg upwards until the foot is grasped. Bend the toe into the hollow of the heel, at the same time keeping the hock bent, then lift the hock over the pelvis, and by still keeping the hock bent and pressed towards the spinal column the remainder of the leg can be brought forward. In like manner the other leg can be brought into position, when delivery can be effected.

Practice in cases of contraction: In all cases in which the cow has been in labour for a considerable period and the fluids from the womb have escaped and contraction taken place, so that the womb has tightly closed upon the fœtus, it is almost impossible to manipulate the limbs into position as described. Under such circumstances it will be necessary to sever the limbs from the body and remove them thigh

foremost. For this purpose a small wire cord with a loop at each end should be used, for which purpose piano-wire will answer admirably. One loop should be taken in with the hand and placed round the thigh and again brought to the outside, when a small handle can be placed in each loop, and by pulling the wire backwards and forwards the limb can be severed from the body in a few minutes. While this operation is going on care will need to be exercised to prevent friction by the wire coming in contact with the passage. A hand placed between the wire and the membranes of the vagina gives the necessary protection. When the legs have been removed the remainder of the fœtus is easily brought forward. To these parts hooks and cords may be attached and by these means extracted. If it is found that this cannot be accomplished the abdominal cavity should be opened and the organs extracted. It will be found that this lessens the resisting forces considerably, and assists in bringing about delivery.

(To be continued.)

WOOLLY FINGER-GRASS.

A DRY-LAND SPECIES WITH POSSIBILITIES.

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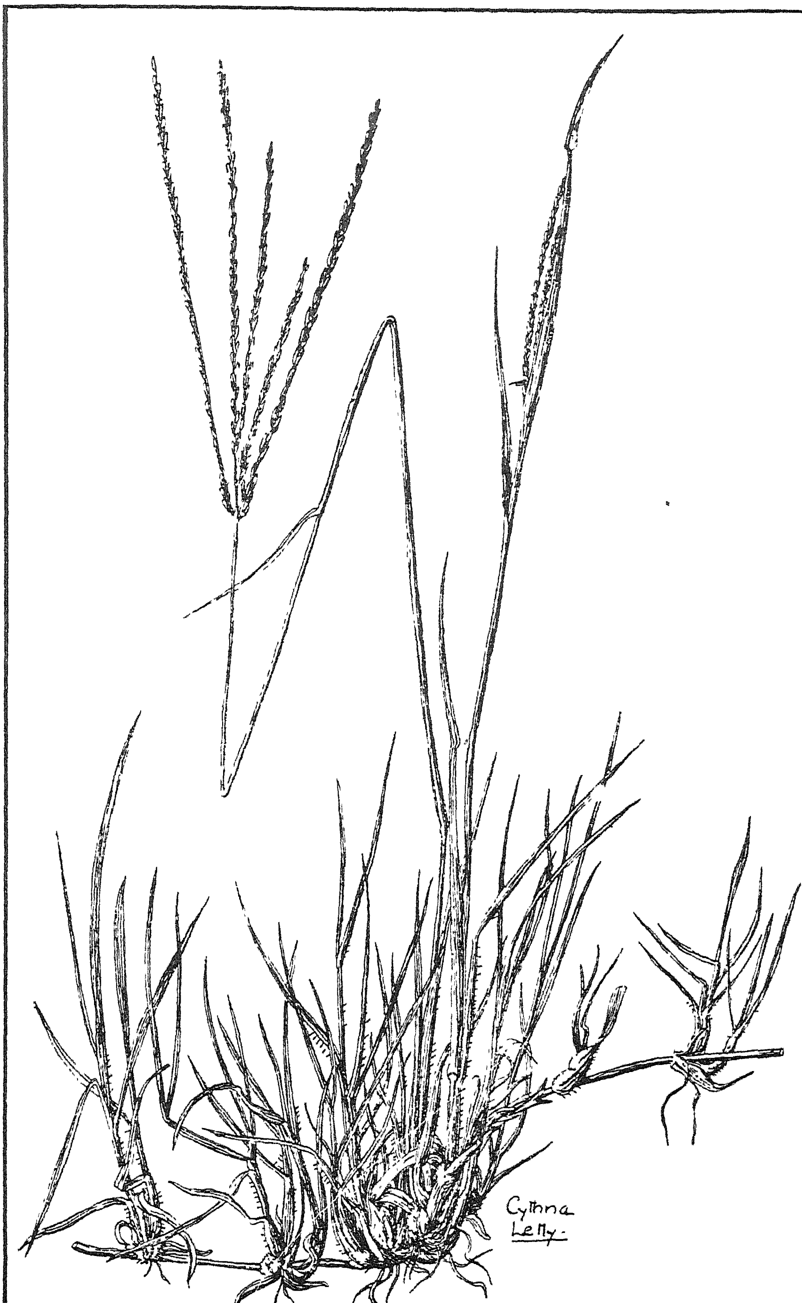
THE grass genus *Digitaria* is made up of some fifty species, mostly weedy annuals. Crab-grass (*D. sanguinalis*) is such a weed species, now plentiful in the warmer parts of New Zealand. On the veldt of South Africa occur a number of species, some of which are perennial and present more or less useful characters. One that has aroused considerable interest in South Africa is woolly finger-grass. As this plant has properties that suggest it may prove of value in areas such as Central Otago, it seems worthy of investigation. Incidentally it illustrates the need for extensive strain study, such as that being undertaken by Messrs. Levy and Davies with perennial rye-grass and other species in New Zealand. Only so can the more useful be separated from the less useful forms. A few notes on the experiments with this grass in South Africa may be of interest at this juncture. The information here given is derived from articles that appeared in *Farming in South Africa*. These were kindly sent me by Miss Sydney M. Stent, Agrostologist, Division of Plant Industry, Department of Agriculture of the Union of South Africa.

The grass first attracted special attention about seven years ago on the experiment farm situated in the Vryburg area, and was identified as *Digitaria eriantha* var. *stolonifera*. It was considered to have a wide distribution in South Africa. A survey, however, revealed that there were many different species, varieties, and strains of stoloniferous digitarias to be met with. While many of these showed close resemblances to the Vryburg grass they behaved differently under cultivation. Miss Stent is therefore making a study of the systematics of these forms, an essential preliminary to economic work. In what follows the Vryburg grass is referred to.



WOOLLY FINGER-GRASS.

[From "Farming in South Africa."

Woolly finger-grass is a tufted perennial, spreading by overground runners. As growing on the veldt the plant has blue-green, rather short leaves, usually softly hairy all over. As it spreads the grass forms a dense cover that smothers out weed-growth. The flowers are developed on about five finger-like spikes at the ends of long branches, but it appears to be an extremely shy seeder. It is essentially a dry-land grass, occurring, for example, on the sandy soil of the Kalahari. "Left to themselves," says Miss Stent and Mr. Pentz, "the farming community would probably never have evolved the idea of planting out pure pastures of woolly finger-grass and using it as a winter feed, for the simple reason that observations would merely have shown them that, like most of the veldt grasses, it became dry and frosted during the winter, and they had no means of knowing of the special properties and qualities in the composition of this grass that gives it such a comparatively high feeding-value in its dried and frosted winter state."

Dr. Henrici, plant physiologist, seeking the cause and nature of the deficiency in the veldt of Vryburg that produces phosphorus-craving in animals, worked out the chemical analyses of many of the grasses, and noted that woolly finger-grass possessed certain qualities lacking in the others. The grass wilts easily, probably because it has less fibrous tissue than the other veldt grasses. In spring, after heavy rains, it contains hydrocyanic acid during wilting, but later in the year there is no trace of this. It is much richer in protein and in carbo-hydrates, and lower in fibre, than the other grasses analysed. Thus it can provide more nourishment even in the brown and dry condition.

A grazing test on six one-acre plots of pure pastures of various grasses was prepared at the Dryland Experiment Station, a cow being placed on each acre. At the end of three years the cow and the woolly-finger-grass pasture were both in excellent condition, while the others had failed to support their animal for even one year. Further tests with cows and with sheep are in progress. The grass, it is recorded, proves extraordinarily resistant to heavy stocking and close grazing, while its close growth conserves the soil-moisture.

"It must be borne in mind," remarks Miss Stent, "that the experiments carried out with this grass and the preliminary results obtained were only under certain local Pretoria conditions, and only with one acre of the grass and with one particular strain. To thoroughly know and understand the grass and its requirements and possibilities it is necessary to carry out wider and more comprehensive experiments on a larger scale, under different conditions, and in other parts of the country."

A small shipment of the grass is being obtained by the Agrostologist, Department of Agriculture, for observation in New Zealand.

Goats and Forests.—"Goats constitute a menace to the Taranaki, Wellington, Nelson, and Canterbury forests," states the annual report of the State Forest Service for 1928–29, "and field officers have been instructed to carry rifles and energetically carry out goat-destruction Experimental shipments of hides have been sent overseas, and it is hoped that favourable prices will be received. The browsing habits of these animals render them second only to deer as destroyers of forest regeneration, and additional sums are necessary to engage shooting parties and to issue free ammunition in certain badly infested areas."

DISEASES OF DAIRY COWS.

(Continued.)

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III. STERILITY.

WHEN one considers the great importance and economic significance of the subject of sterility in dairy cows, it is really surprising to find how comparatively little useful work has been accomplished, and also the marked disagreement in published works. The writer has therefore attempted to record some of the latest views on this all-important and difficult problem, and at the outset would wish to express his indebtedness to several of his veterinary colleagues on the Continent of Europe for many of the opinions here expressed, and for their personal views on the subject. He would name in particular Professor Folmer Nielsen, of Copenhagen, Professor Stalfors, of Stockholm, and Professor Goetze, of Hanover, authorities whose kindness and assistance have been of the greatest value. Professor Folmer Nielsen gave his valuable time, excellent equipment, and many years of practical experience for demonstrating his methods of diagnosis and treatment of cases of sterility.

In the first place it should be noted that "sterility" is to some extent a misleading term, since in the strict sense it means inability to reproduce, and this occurs in a relatively small number of cases only. The more correct designation would therefore be "diminished fertility"; or, again, it would suffice to define the term as "diminished faculty" of the female (at any rate at the given moment of service) to become pregnant and to preserve and continue this pregnancy, until the latter is either capable of being diagnosed by rectal palpation or until an interruption of the pregnancy sets in as an observable abortion (Nielsen).

It should also be remembered that infertility or sterility is not a definite disease, but rather a failure of a functional capacity which may arise from any deviation from the normal, such as malformations, diseases of different kinds, defective nutrition, or even heredity. Whenever there is a defect in an organism and its functioning it is most important to find the causes, this being the first necessity in order to remove the defect. There are general or indirect and local or direct causes at work, such as endocrine disturbances, nutritional defects, and diseased conditions, both general and local.

GENERAL OR INDIRECT CAUSES.

During recent years heredity has been considered to produce the anomaly in question in different ways, and yet on this point opinions are much divided. Many circumstances argue against heredity, but, on the other hand, in certain cases there appears to be striking proof in favour of it. It is difficult to avoid the suspicion that heredity plays a part, that the defect is congenital, though great if not insuperable difficulties stand in the way of securing full proof. There are at present

no methods of procedure in the study of heredity other than genealogical and statistical, but it is to be hoped that, in the future, both the study of the sex cells and experimental breeding will reveal possibilities at present unknown. In the meantime, therefore, we are not justified in rejecting the possibility of the operation of hereditary factors in sterility, and must always take into account such possibilities. Accordingly, the attention of breeders must be drawn to the fact that breeding should be avoided in families where there appears to be an hereditary tendency to sterility

As regards the more general causes of reduced fertility, during recent years the view has been brought into great prominence that too intense production has a depressing effect on fertility. It appears very obvious that if cows are treated more as milking-machines than as living organisms, and an attempt is made to concentrate all their energies in the udder and to extort from them the greatest possible yield by milk-stimulating foods, the organism as a whole will be weakened, and thus also the genital system. It is perhaps not easy to prove this by means of figures, but that it is a fact is a matter of general experience and is now universally admitted. Again, the intensely producing herd is generally more susceptible to disease, which might have an indirect effect upon fertility.

In recent years a definite reaction has taken place against this over-production, as, for example, in the new system of judging Ayrshire dairy cows in Scotland, and it has come to be more generally accepted that in the long-run the ultra-intensive system is economically unsound. From the nutritional point of view, the older workers attributed to feeding a great influence on fertility; in fact, the Swiss worker Zschokke attributed "persistence of the yellow bodies" to feeding on brewers' and distillers' grains. So far, however, no such specific effect can be attributed to these or other feeding-stuffs.

The effect of food, however, is important in many different ways. A general insufficiency, an excess under certain circumstances, a want of balance of the various constituents, an excess of one or a deficiency of another may contribute considerably to this all-important problem by upsetting the endocrine activities, by lowering resistance to disease generally, and by favouring debilitating and depressing effects on the genital tract. A deficient supply of food, or, in other words, a starvation diet, has a marked effect, if prolonged, upon the sex organs, as was found in Germany and Sweden during the war.

Nowadays the food requirements of farm animals are no longer assessed solely in terms of protein, carbohydrates, and fat; other constituents have been proved to be of the greatest importance in nutrition, and these are mainly to be found in the ash or mineral content of the ration. Vitamins or accessory food factors have been described as occurring in certain foods or absent in others, and their function in the metabolic processes or physiological activities has been extensively studied. "Deficiency disease" will therefore result when there is deficiency of one or other of the essential constituents for normal growth and existence.

One must realize that there may be deficiencies which, though not so marked as to cause gross signs of malnutrition or disease, yet may limit the rate of growth, the productivity, or even the fertility of the

individual, in addition to increasing its susceptibility to disease. Veterinarians have devoted themselves to the study of the clinical manifestations of many deficiency diseases, agronomists have interested themselves in the wider general problems of pasture husbandry, and chemists and bio-chemists have sought to find an explanation of such diseases by careful analyses of soils, pastures, foodstuffs, and animal products. In this way a considerable amount of data is now available in many countries of the world which shows the importance of the study of nutrition in both health and disease. The composition of the pasture is reflected in many ways by the productivity, the fertility, and even viability of the animals grazed thereon. The growth-rate of cattle in the natural state is slow as compared with that of domesticated breeds, and the amount of milk produced is limited to that required by the calf. In the natural state, therefore, cows would produce from 200 to 300 gallons in a lactation period, whereas in modern dairy breeds the yield is commonly 750 to 1,000 gallons.

This improvement in the cow must be accompanied by an improvement in the pasture if the higher yields are to be maintained, or obviously a depletion of the soil must result. In many parts of the world this depletion of the land has been permitted to occur by the removal of beef, mutton, milk, wool, and similar animal products, without a corresponding return of the essential elements for adequate plant-growth in the form of chemical fertilizers. This has occurred in the western Highlands of Scotland, in the Falkland Islands, in the pastoral lands of parts of Australia, in India, and obviously to a greater or less extent in all grazing countries. Again, the geological origin of the soil in many countries is responsible for deficiencies in certain minerals, and accordingly if these are not supplied the introduction of improved breeds of live-stock is doomed to failure. Under both circumstances the result will be the same; in the absence of gross signs of disease, a general malnutrition, some degree of emaciation, and impairment of growth occurs, and in full-grown females the breeding-capacity is affected and the milk-yield lowered.

In the valley of the Red River, in Minnesota, the fertility of the cows was low, and a deficiency of phosphorus was shown to occur in the whole district. Lack of ovulation with resulting sterility has been proved to be due to this deficiency, and the feeding of bone-meal or the application of phosphatic manures has resulted in a return to normality. In British Honduras pica or depraved appetite has been noted, sterility is high and milk-yield low; but sufficient evidence has not yet been amassed to definitely establish the cause of the trouble or to furnish a reliable treatment. In Bihar, India, and on the coast of Malabar, where there is a deficiency of phosphorus, mortality among cattle is high, sterility is common, and milk-yield is again low. These, of course, are extreme cases, yet they will suffice to stress the importance of nutrition as affecting the breeding-capacity of bovines. Many more areas could be cited and greater detail given.

LOCAL OR DIRECT CAUSES.

Having thus considered briefly the more general or indirect causes of sterility, we now come to the local or direct causes of this state of affairs. It is unfortunate that here the agreement as to the precise

cause and the best treatment to adopt leaves much to be desired. The causes which favour reduced fertility are to be found in one part or other of the genital tract, as anomalies of the various sex organs, especially the ovaries and uterus or womb. Accordingly this brings us to the parting of the ways with regard to the cause or etiology and treatment of sterility in bovines. Since the problem of sterility in dairy stock has assumed such great importance in the older dairying countries, it is to Denmark and Germany that one must largely look for the necessary assistance in diagnosing and controlling these diverse breeding anomalies.

The German authorities, following Hess, maintain that the seat of the trouble is to be found in the ovaries, and accordingly the chance of success is only to be fostered by ovarian treatment. Hess referred local causes to the ovaries, and found in them "persistent yellow (lutein) bodies" and "cystic degenerations," which could be treated successfully by expression of the yellow bodies and rupture of the ovarian cysts. It was only in cases of purulent metritis that there was any indication for the washing-out of the uterus.

In Denmark Albrechtsen maintained that the uterus or womb was all-important, and thus one was confronted with an endometritic sterility which demanded a purely uterine treatment. This worker considered that the chief and commonest cause of sterility was an inflammatory condition of the uterus, a chronic catarrh. This was assumed to account for the cystic degeneration of the ovaries, and "persistent yellow bodies" were regarded as having no true significance. Accordingly, treatment was confined chiefly to the uterine catarrh, and consisted of antiseptic irrigations, but ovarian cysts were ruptured and "persistent yellow bodies" left untouched. It was considered that expression of the "yellow bodies" would injure the functioning of the ovaries and have a depressing effect on fertility.

At the present time, especially in Europe, a compromise has been arrived at between the two schools, and it is now considered that each individual case must be diagnosed and treated on its own merits. In other words, an individual combined treatment is employed, as first recommended by Stalfors in 1912. On the one hand ovarian treatment, which includes expression of the "persistent yellow bodies," or rupture of the "cysts," may be employed with some measure of success. Stalfors claims 92 per cent. success by expression of the "yellow bodies," and only 80 per cent. by rupture of the "cysts," when no other form of treatment was employed; on the other hand, uterine injections and irrigations alone gave astoundingly good results. To obtain the best results, therefore, a combination of both uterine and ovarian methods of treatment must be employed—in some cases one or other, and in others both methods.

SEX PHYSIOLOGY.

Since a clear understanding of the varying nature of the sterility phenomena can only be acquired by the study of these phenomena in the light of modern scientific sex physiology, it will perhaps not be out of place to review the information regarding the normal physiology of the female animal.

The ovary must be considered the altogether dominating portion of the genital complex, as it exerts a comprehensive influence, not only on the rest of the genital organs, but also on the physical and psychical state of the individual generally. Again, it is to be remembered that this influence is of a chemical nature, due to the activities of the ovaries as an endocrine or ductless gland. The ovarial function is closely associated with the appearance and disappearance of certain different tissue formations within its substance. Within the ovary are to be found thin-walled follicles containing the eggs or ova, which are liberated when ovulation takes place at each œstrum or "heat." The ovum passes down the tubes into the uterus, where fertilization is possible at time of service, when conception occurs. The ruptured follicle now heals over and constitutes the "yellow body" of œstrum or pregnancy, when it persists as a ductless gland of varying size, duration, or activity. The opening from the vagina into the uterus or womb is by way of a short canal, called the cervix, which becomes sealed during pregnancy. The normal occurrence of œstrum or "heat" is regulated by the normal function of the sex glands, probably more especially by the activities of the glandular tissue of the ovary and, as some authorities suggest, probably even by the follicular apparatus

The glandular tissue of the ovary and also the follicular apparatus are governed by the "yellow bodies" in their cyclical changes It is evident that normal heat and accordingly ovulation or ovum production must be considered as the all-important side of ovarian activity. Therefore the œstrum occurring in connection with ovulation may be called normal, whereas abnormal heat manifestations may occur in animals which are continuously in heat, or occasionally during pregnancy. The temporal relationship between the occurrence of ovulation and the appearance of heat or œstrum is most important, and in the latest work on the subject it has been suggested as furnishing the explanation of many cases of temporary sterility in bovines. Krupsky and Schmidt recently stated that ovulation takes place during œstrum, and according to Zietschmann it occurs most frequently during the latter part of heat. Nielson, as a result of his extensive examination of normal as well as sterile cows, considers that most probably ovulation really often occurs immediately before or during the first stage of heat, but that the time of ovulation relative to œstrum may, and certainly does, vary considerably. In the cow it is quite easy to imagine that abnormalities of nutrition or disease may occur to such an extent that heat and ovulation do not necessarily accompany or condition each other. In fact, it is important to understand that ovulation frequently occurs without any evident manifestation of heat. According to the Continental workers heatless ovulation in the cow is exceedingly common, and this occurs frequently during the first two or three months after calving. The more lengthy absence of œstrum in the abnormal cow is stated, therefore, to be due to a chronic endometritis or inflammation of the womb. In cows suffering from endometritis heat manifestations after the third month are frequently very irregular; this irregularity increases with the degree of endometritis present, and in very severe cases there is even a complete absence of heat.

CAUSES OF FUNCTIONAL DERANGEMENT.

Having thus considered the physiological derangement which is now generally accepted as causing non-conception, whether on account of ovulation not taking place or by failing to coincide with the outward manifestation of heat, it will next be necessary to outline the many causes responsible for this derangement This brings us now to the individual animal, and before a clear understanding of the pathogenesis of each individual case can be attained, each part of the genital tract must be considered separately, and the sterilizing anomalies found in each part carefully recorded

An accurate diagnosis must be arrived at in every case of sterility before any line of treatment can be decided on, as it is imperative to locate the position of the sterilizing anomaly or anomalies. Abnormalities, malformations, and inflammations must be looked for in the ovaries, the tubes, the uterus, the cervix, and in the vagina. In the ovaries cystic degeneration may occur, so-called "persistent yellow bodies," inflammation (oophoritis), tumours, and hormonal defects, both congenital and acquired In the tubes is usually found an inflammation within or around, which has resulted from an extension from the uterus; within the uterus an endometritis, which may be classified as puerperal—that is, occurring during the three weeks after calving, and catarrhal or chronic.

The Danish school consider that practically all cases of sterility result from an endometritis or inflammation of the womb, and accordingly a considerable amount of information is now available in support of this theory. Cystic degeneration of the ovarian follicles is not invariably accompanied by a catarrhal or purulent endometritis, and according to Professor Nielson the so-called "persistent yellow bodies" are in fact normal cyclical yellow bodies, arising after spontaneous ovulation and regressing in the normal time, but out of all relationship to heat. Expression of these yellow bodies gives rise to a new ovulation in closer temporal relationship to heat, and accordingly conception is more likely to occur.

Finally, sterilizing anomalies of the cervix and vagina include, as before, congenital and acquired deformities, tumours, and inflammations—namely, cervicitis and vaginitis.

As regards both granular and vesicular vaginitis, conditions which were regarded until recently in Germany and elsewhere in Europe as the main cause of sterility, it may be stated definitely that they have little to do with infertility, except perhaps in heifers in very acute cases, when service may be resented and conception made impossible. Yet heifers very badly infected have conceived at first service. Vaginitis may, of course, aggravate a cervicitis, but not necessarily condition such a state.

ENDOMETRITIC STERILITY.

Assuming that all cases are invariably endometritic in origin, the question then arises as to the possibility of infection. In many cases this is definitely established, but in the mild catarrhal state the position is different. This raises the question of whether the antiseptic solutions now used as uterine injections act as disinfectants by destroying the

infection, or merely stimulate the organ. Professor Stalfors, of Stockholm, has taken uterine washing with sterile water by means of a sterile catheter into a sterile vessel, and a bacteriological examination of such washings has failed to show any evidence of infection. Histo-pathological examination of the uterus *post mortem* has occasionally shown evidence of a definite endometritis Stalfors therefore holds regarding this failure of involution, which is so common, that it is better to talk of an asthenia, weakness, relaxation, or inactivity rather than a uterine catarrh, and that treatment should consist rather of a stimulating or strengthening nature than of a bactericidal.

If this is the true explanation of the condition it is interesting to note that the uterus can be stimulated in many different ways without internal treatment, by massage per rectum, by treatment of the ovaries and of the vagina, &c. Treatment of the vagina has its adherents, and many solutions have been tried, such as methylated spirits, tannin, &c. A definite stimulation of the uterus can be shown to occur, and a much stronger reaction is produced by treatment of the vagina than by treatment of the uterus.

TREATMENT.

When a diagnosis has been arrived at it is essential to plan the treatment in order to remove the sterilizing anomaly, but it can be appreciated that a considerable number of cases will not warrant any intervention, as the condition will of necessity be permanent.

The uterine treatment now generally adopted in Europe is a modification of that introduced by Albrechtsen in Denmark — namely, a simple injection of an iodine solution, usually a solution of iodine in potassium iodide containing one to two parts of iodine per thousand. A catheter is passed into the uterus, and 200 c.c. of the solution is divided between the two horns or branches of the uterus, and usually left in the uterine cavity. Stalfors claims over 80 per cent. success with his individual treatment, and Nielsen in Denmark about 70 per cent., whereas the German authorities seem to have poorer results. In the writer's opinion this might be due to the fact that in Germany the uterine irrigation is carried out by means of a return-flow catheter, whereas at least in Denmark an injection of iodine solution is made into both horns and left in them. The stimulating effect of the iodine both on the uterus and ovaries may be responsible for the greater success attending the latter procedure.

Expression of the "persistent yellow bodies" and rupture of the ovarian cysts is undertaken in selected cases, and great success is claimed for this method of intervention, even in the absence of uterine injection or irrigation.

It should be noted that the treatment here outlined must be carried out by a skilled veterinarian, but in cases of vaginitis the treatment can be undertaken by the owner himself. Mild saline or antiseptic irrigations are indicated, but on no account should they be given just prior to service.

(Series to be continued.)

NOTE.—Temporary sterility will be dealt with in the next article of this series.—ED.

HOGGET MORTALITY AND ITS PREVENTION.

Live-stock Division.

THE experience of the past two seasons in both the North and South Islands has demonstrated that the successful rearing of lambs after weaning—carrying them through the autumn and winter with a minimum of loss—is a subject which requires close attention by sheep-farmers. It must be realized that sound management and feeding of the flock are the main principles upon which to base successful rearing.

With the weaning-period again at hand an attempt should be made to meet any abnormal conditions, prevention being better than cure. The outstanding factors in regard to the mortality in the last two seasons were feed conditions and parasites These factors were considerably aggravated by the seasonal climatic conditions, in which an increased rainfall associated with mild humid weather resulted in a more or less rank growth of pasture. The unsuitability of such feed for sheep is undoubted. On account of their close-grazing habits short feed, with a fair proportion of fibre to assist in rumination, is the most suitable pasture for sheep of all ages

Sheep do better when grazing-pastures have been eaten down by cattle. The cattle population has undoubtedly decreased of late years on many farms which in previous years carried sheep without any very serious mortality. Here is one reason for the unsuitable feed conditions in some cases. On low-lying flats with a high carrying-capacity the sheep-pastures are more liable to become contaminated ; the pastures become " sheep-sick " on account of the absence of cattle. If heavy growth occurs in the autumn months and sheep are unable to control it, the feed not only becomes unsuitable for them, but also makes excellent cover for the spread and propagation of internal parasites. These unfavourable factors are thus met with by lambs at the most vulnerable period in their life. There is no doubt that when the lambs are weaned, after the loss of the mother's milk and while the rate of growth and the demand for nourishment are both imperative, any set-back, together with a possible infestation with internal parasites, renders the animals typical cases for hygienic attention and treatment.

An important point in this connection is the fact that the early lambs and those which have the best foundation for surviving any critical stage are as a rule drafted off their mothers and killed for the meat-export trade. This only emphasizes the need for greater attention to the feeding of the other members of the flock and those relegated to the cull class by the fat-stock buyer. The far-reaching results of the system of selling off the earliest and best lambs for the fat-lamb trade have been recognized by many farmers. Not only is this important in relation to the constitution of the breeding flock in later years, but other factors such as breeding-capacity and wool-deterioration must be considered.

Lambs should be weaned as early as possible within reason, depending on the season and the state of the pasture available after weaning. Late lambs require special supplementary feeding at time of weaning.

and the encouragement of lambs to take dry nourishing feed is a practice worthy of considerable extension. A salt lick should always be provided The use of good clover hay in racks, or a daily feed of crushed oats and/or linseed, makes an excellent substitute for the loss of milk. The lambs should be weaned on to as clean pasture as possible, preferably that which has been grazed by cattle. With a scarcity of suitable pastures owing to a shortage of cattle, any clean paddocks which have been under cultivation and are carrying a young grass crop may be used for the lambs. A paddock from which a crop of hay has been saved may be used, provided the feed is not allowed to become rank before use These remarks apply more particularly to the rich flats where the carrying-capacity is greater than on more hilly country. The lambs should not be put on in too great numbers ; overstocking must be avoided. On the hill country there is less difficulty as a rule in regard to parasitic trouble. Low-lying or damp areas of any kind should be avoided for the weaner lambs.

On farms where it is possible to grow early rape, grass, oats, barley, or any other suitable green feed, such feed will give the lambs a good start , late lambs in particular need special treatment. Thousand-headed kale is a useful standby. With any of these supplementary green feeds care is necessary until the lambs become accustomed to the new diet, and it is always advisable to have a run-off on grass. Lambs running on pasture country should be changed regularly. The weaker lambs or hoggets may be separated from the rest of the flock and put on feed of a more invigorating nature. Young lambs may be taught to feed from troughs or racks while still suckling their mothers, so that when weaning takes place such feeding may be continued and increased. Self - feeders would prevent the necessity for daily attention by the farmer or shepherd.

A practice which has been followed with considerable success in some districts is that of grazing the paddocks first with the older sheep, and afterwards with the lambs and younger sheep. This practice has had to be adopted where no clean pastures were available upon which to wean the lambs. It may be here argued that the older sheep have in this way every opportunity of contaminating the pastures with the eggs and embryos of parasites, but the counteracting factor is that the feed is rendered more suitable for the young stock. This advantage appears to outweigh any disadvantage.

The higher country has many advantages over the rich flats in a rainy mild autumn. The drier soil with its less luxuriant growth and also with a lesser tendency to the spread of parasites is more suitable for the younger sheep when clean pastures cannot be obtained on the flats. On the flats, where the carrying-capacity is high, the possibilities of closer subdivision with rotational grazing are considerable. Under this system not only would a frequent change of pasture be provided, but the pasture could be better kept in control, and any long luxuriant growth could be shut up and utilized for the production of ensilage and hay for winter feeding. Moreover, such areas would provide a fairly clean pasture upon which to wean lambs. The conserved herbage would be put to better advantage in providing winter fodder than by being trampled down.

With regard to the treatment which may be adopted once evidence of parasites is obtained, in the first place it must be again mentioned

that a sick sheep is difficult to treat either medicinally or by increased dieting. Lambs should be taught to feed early, and extra feeding is one of the main factors in the treatment of parasites. Medicinal agents can be relied upon only as subsidiary to the feeding and management precautions already outlined. Adult sheep harbour parasites, and the ova or eggs reach the pasture, where under suitable conditions of temperature and moisture the larvæ hatch out and are swallowed by animals grazing such pastures. The symptoms set up and the losses met with, especially in young animals, are fairly well known.

Several agents have been used for dosing infested sheep. Probably that most commonly used and proved to be effective against the stomach-worm is a 1-per-cent. solution of copper sulphate (bluestone). The dose varies with the age of the sheep to be dosed, from 6 drams for a young lamb to 3 oz for an adult sheep. Early dosing as soon as possible after weaning is quite essential in a rainy autumn. Dosing can be repeated every three weeks. Other agents used include turpentine, which may be given in milk or in raw linseed-oil. If given in oil a little soda may be added and the whole made into an emulsion. From a teaspoonful to a dessertspoonful may be given to each animal, depending on its age. Besides its vermicidal properties, turpentine in medicinal doses appears to have a stimulating effect in the case of weak animals. There are numerous other preparations used for worms in sheep, but those just mentioned are most commonly employed.

In conclusion, the factors concerned in the prevention of hogget mortality may be summarized as follows:—

(1) Wean lambs early on to clean pasture, if available.

(2) Pastures which have been grazed by cattle are most suitable.

(3) If clean pastures are not available the lambs should be taught to feed from troughs before or after weaning, weaned on to the driest paddocks, and supplementary feeding increased after weaning.

(4) In wet seasons early dosing soon after weaning is advisable, to be repeated as necessary.

(5) Avoid overstocking with the young animals.

(6) The possibilities of closer subdivision of paddocks, rotational grazing, the shutting-up of paddocks in case of heavy growth, and the utilization of the herbage as ensilage or hay, offer great possibilities for providing a clean area upon which to wean lambs.

(7) Where arable farming is carried out in the production of supplementary green crops a clean area should be obtainable upon which to wean lambs.

(8) Late lambs require more attention than early lambs; sick lambs are the most difficult to treat.

Careful observation for the first indications of going off in health and condition are necessary, and one of the essentials is to train the young animals to take good dry feed while they are fit and well, so that if a flush of unsuitable autumn feed comes about the unfavourable feeding conditions can be corrected by a ration of good dry feed, which the hoggets will then take readily. If not trained to dry feed, and an attempt is made to get them on to it after sickness has manifested itself, usually they will not take it at all, with a resultant heavy mortality.

GORE EXPERIMENTAL AREA.

RECORD OF THE 1928–29 SEASON'S WORK.

R. B. TENNENT, Fields Superintendent, Dunedin

DURING the season of 1928–29 considerable investigational work was carried out at the Gore Experimental Area in regard to the manurial practices adopted for various crops in that part of Southland. The chief objective so far as the individual experiments were concerned was an endeavour to ascertain by exact experimental methods the differences which occurred in crop-growth as a result of the application of various fertilizers. To this end the old subdivisions of the Area were discarded and larger - sized blocks pegged out, in order to allow sufficient room for a large number of replications of each experiment. Generally speaking the season proved an excellent one, and growth was good in all plots throughout the year. The spring, however, was if anything wetter than is normal, consequently the supposedly deleterious effect of superphosphate on the germination of turnip and swede seed was not noticed.

Particulars of the various experiments are given in the following matter.

Swede Manurial Trials (Block 1).

Four experiments, designated A, B, C, and D, were conducted on this block. Hunsballe variety of swede-seed was used in Experiments A, B, and D, sown in 26 in. ridges at the rate of 20 oz. per acre. This seed, of Danish origin, germinated at 82 per cent. In the case of Experiment C, Webb's Masterpiece swede was sown.

Experiment A.

The object of this experiment was to ascertain the effect upon germination and subsequent growth of swede-seed when varying quantities of superphosphate were sown in direct contact with the seed. The experiment was sown down on 9th November, 1928. Each treatment, consisting of two drills, was replicated ten times. Experience in Canterbury indicated that the practice of sowing superphosphate in large quantities in direct contact with the seed had a damaging effect upon its germination, and in this experiment an attempt was made to definitely ascertain the amount of super which could be thus sown without such injury proving of much moment. In addition the effect of mixing super and lime was also put under trial, on the assumption that such a mixture could be sown with impunity so far as germination injury is concerned.

Treatments per acre were carried out as shown in Table 1, the carbonate of lime and super being mixed three weeks prior to sowing. The super used in this and other trials here recorded was 44/46 per cent. grade.

The crop was weighed on 23rd May, 1929, and at that date was fairly heavily infected by club-root and dry-rot. Germination counts were taken when the young plants were in the two-leaf stage; each

number given in Table 2 is an average of 100 counts on a 10 ft. length of one row. Each yield-figure given represents an average of sixty weighings of ½-chain length in one row

Table 1

No	Treatment.	Rear Box	Front Box	Total
		Cwt.	Cwt	Cwt
1	Super 3 cwt.	..	3	3
2	Super 3 cwt	¼	2¾	3
3	Super 3 cwt.	½	2½	3
4	Super 3 cwt	1	2	3
5	Super 3 cwt, lime 3 cwt .	1	5	6

NOTE—Manure from rear box of ridger falls with seed; manure from front box falls below seed.

Table 2.

No	Treatment	Average Number of Plants per 10 ft. Row (100 Counts)	Relative Germination.	Yield in Tons per Acre.
			Per Cent.	
1	Super	54·5	100	27·8
2	Super	36·8	67	25·9
3	Super	43·1	79	28·3
4	Super	36·7	67	26·1
5	Super + lime ..	50·9	94	29·2

So far as the germination counts are concerned it is to be noted that any difference greater than 5·5 plants per 10 ft. is significant. It will be observed that apparent inconsistencies occur in the treatments where ¼ cwt. and 1 cwt. of super sown with the seed have lowered germination to a greater extent than where ½ cwt. of super was sown. This is at present inexplicable, and further investigations will be made. In regard to yield, Treatment 2 gives a significantly lower yield than Treatment 1; Treatment 4 is significantly lower than Treatment 3; Treatments 1 and 5 do not differ significantly It will also be observed that those plots having the lowest germination have the lowest yields.

Experiment B.

Sown down on 13th November, 1928, this experiment was designed to determine the effect of varying proportions of super plus lime when sown in contact with the seed, and to compare that mixture with super plus Ephos phosphate plus lime in germination and yield. Twelve replications of each treatment were carried out.

Table 3 shows the treatments per acre, the carbonate of lime and super being mixed three weeks prior to application.

The crop was weighed on 24th May, 1929, each yield recorded being an average of fifty weighings of one row by ½ chain in length. The germination counts are averages of 104 counts on a 10 ft. length of one row. Results are given in Table 4.

At the date of weighing portion of the crop was badly infected with club-root, and consequently weighings were taken from five replications only. Germinations may be regarded as not differing significantly

Table 3.

No.	Treatment.	Rear Box.	Front Box.	Total.
		Cwt.	Cwt.	Cwt.
1	Super 3 cwt., lime 3 cwt. ..	.	6	6
2	Super 3 cwt., lime 3 cwt. ..	½	5½	6
3	Super 3 cwt., lime 3 cwt. ..	1	5	6
4	Super 3 cwt., lime 3 cwt. .	2	4	6
5	Super 1½ cwt., Ephos 1½ cwt., lime 1½ cwt.	¾	3¾	4½
6	Super 1½ cwt., Ephos 1½ cwt., lime 1 cwt.	1	5	6

Table 4.

No.	Treatment.	Average Number of Plants per 10 ft. Row (104 Counts).	Yield in Tons per Acre.
1	Super + lime	53·0	26·7
2	Super + lime	54·9	25·1
3	Super + lime	55·9	27·6
4	Super + lime	51·0	22·6
5	Super + Ephos + lime 1½ cwt. ..	52·6	26·9
6	Super + Ephos + lime 3 cwt. ..	50·2	23·4

from one another, but in regard to yields Treatment 4 is significantly lower than Treatment 3. This appears to be inconsistent with the fact that Treatment 3 is superior to Treatment 2. Treatment 5 is significantly better than Treatment 6. Unless these results were due to the effect of extra lime reducing the efficiency of Ephos, it is difficult to explain them.

Experiment C.

In this experiment an endeavour was made to determine the relative merits of various phosphates when sown alone or in conjunction. The effect of super plus lime compared with these mixtures was also put under trial. The experiment was laid down in twelve replications of each treatment on 15th November, 1928, in this case Webb's Masterpiece variety being sown. The following treatments were applied:—

Table 5.

No.	Treatment.	Rear Box.	Front Box.	Total.
		Cwt.	Cwt.	Cwt.
1	Super	½	2½	3
2	Seychelles phosphate	½	2½	3
3	Ephos	½	2½	3
4	Super 1½ cwt., Ephos 1½ cwt. ..	½	2½	3
5	Super 3 cwt., lime 3 cwt. ..	1	5	6

Germination counts were taken on 21st December, 1928, and the crop finally weighed on 9th August, 1929. At the date of weighing the swedes were badly infected with dry-rot, but less club-root was present than was the case in Experiments A and B. Each yield represents an average of seventy-two weighings of one row by ½ chain in length. The following table gives results :—

Table 6.

No	Treatment.	Average Number of Plants per 10 ft. Row (108 counts).	Relative Germination	Yield in Tons per Acre.
			Per Cent.	
1	Super	41·2	86	36·5
2	Seychelles phosphate ..	44·1	92	35·6
3	Ephos .. .	44·2	92	35·0
4	Super 1½ cwt., Ephos 1½ cwt.	46·6	97	36·4
5	Super 3 cwt., lime 3 cwt	48·1	100	37·4

In regard to the figures relative to germination it is to be noted that any difference greater than 3·2 plants per 10 ft. may be regarded as significant. Although Treatments 2 and 3 are barely significantly better than No. 1, the difference is probably a real one. So far as the yield results are concerned that given by Ephos is significantly lower than those of super, super plus Ephos, and super plus lime. Seychelles does not differ significantly from super.

Experiment D.

The chief object in regard to this experiment was to determine the effect on germination and yields when using potash as an adjunct to super alone and in conjunction with lime, and at the same time to ascertain the effect on swedes of nitrogen in the form of dried blood. The seed was sown on 14th November, 1928, each plot being replicated twelve times. The following treatments per acre were given, the manures being mixed three weeks previous to sowing :—

Table 7.

No.	Treatment	Rear Box.	Front Box.	Total.
		lb.	lb.	Cwt.
1	Super 3 cwt.	56	280	3
2	Super 3 cwt , lime 3 cwt.	112	560	6
3	Super 3 cwt., lime 3 cwt. + 30 per cent. potash 1 cwt.	131	653	7
4	Super 3 cwt., lime 3 cwt., potash 1 cwt , blood 1 cwt.	149	747	8
5	Super 3 cwt , 30 per cent. potash 1 cwt.	75	373	4

In this experiment dry-rot and club-root were present to a slight extent. Weighings were taken on 5th and 6th July, 1929, each yield-figure in Table 8 representing an average of seventy-two weighings of one row by ½ chain in length. Germination counts were also taken at the same time as in the previous experiments. The following yields and counts were recorded :—

Table 8

No	Treatment.	Average Number of Plants per 10 ft of Row (108 counts)	Relative Germination.	Yield in Tons per Acre.
			Per Cent.	
1	Super . . .	41·2	91	39·8
2	Super + lime	45·1	100	38·9
3	Super + lime + potash . .	39·5	88	45·6
4	Super + lime + potash + blood	39·4	88	45·0
5	Super + potash . .	37·8	84	45·2

In regard to the germination results, any differences greater than 3·6 plants per 10 ft. may be regarded as significant. Potash apparently has had a slight effect on germination, which appears to be worst when used in combination with super alone. All plots are significantly higher in yield than Treatments 1 and 2. Neither lime nor blood have influenced yield, which is rather the reverse to general experience.

Grass-seed Origin and Strain Trial (Block 2).

This block of 5 acres in extent is at present laid down to various strains of rye-grass, sown in conjunction with different species of other grasses. It is not intended to give particulars of this experiment in the present report, as it will be dealt with at a later stage by the Agrostologist, who is directly conducting the experiment.

Oats Manurial Experiment (Block 3).

Three experiments—A, B, and C—were sown down in this block, a commercial sample of Garton's oats being used for the purpose. All seed was pickled prior to sowing, and a good germination was experienced throughout.

Experiment A.

This experiment consisted of a simple trial of varying quantities of super as compared with no-manure and Ephos, the treatments being sown out with the seed on 30th October, 1929. Each plot was replicated ten times, and harvested and weighed on 9th March, 1929. On 25th March further weighings were made to determine the loss in moisture which had taken place from the date of cutting until the date of stacking. All weights given in Table 9 indicate the amount of chaff per acre. In regard to the yields, it is to be noted that each figure is the average of twenty weighings.

Table 9.

Treatment per Acre	Yield per Acre.	Increase over No-manure.	Weight when ready to stack as Percentage of Weight when cut.
	Tons.	Tons.	Per Cent.
No manure	2·29	. .	55
Super 1 cwt.	2·55	0·26	56
Super 2 cwt.	2·65	0·36	55
Ephos 2 cwt.	2·23	. .	54

At the date of harvesting smut was prevalent throughout. The superphosphate plots were much taller in growth and more mature than the Ephos and no-manure plots, which were about equal, both being badly infested with yarr (*Spergula arvensis*). The plot sown with super at the rate of 2 cwt. per acre appeared best throughout. The super 1 cwt. and 2 cwt. increases are both significant, but do not differ from one another to a significant extent.

Experiments B and C.

These concerned the trial of different methods of applying nitrogen and the use of different forms of nitrogen At the present stage results are not sufficiently conclusive to warrant publication.

Turnip Manurial Trials (Block 6).

Three turnip manurial trials were laid down on exactly similar lines to those of the swede trials already recorded. The trials were sown with Aberdeen Green-top yellow turnip at the rate of 20 oz. per acre, each plot consisting of two rows replicated ten times. As the object of each experiment has already been dealt with in connection with swedes, results of field germinations and yields only will be given in this section.

Experiment A.

This was laid down on 21st November, 1928. Germination counts were taken on 20th December, and the crop weighed on 18th and 20th June, 1929. The following treatments per acre were given, carbonate of lime and superphosphate being mixed in the case of this experiment, and also in B and D, approximately three weeks prior to owing.

Table 10.

No.	Treatment per Acre	Rear Box.	Front Box.	Total.
		Cwt.	Cwt	Cwt.
1	Super 3 cwt . ..	..	3	3
2	Super 3 cwt	¼	2¾	3
3	Super 3 cwt	½	2½	3
4	Super 3 cwt.	1	2	3
5	Super 3 cwt. + lime 3 cwt ..	1	5	6

Results of field germination and yields were as follows:—

Table 11

No.	Treatment.	Average Number of Plants per 10 ft Row (100 Counts).	Relative Germination.	Yield in Tons per Acre.
			Per Cent.	
1	Super	36·6	89	28·2
2	Super	40·1	97	28·6
3	Super	35·5	86	28·4
4	Super	26·5	64	28·5
5	Super + lime ..	41·2	100	29·2

Each yield is an average of sixty weighings of one row by ½ chain. In regard to the germination figures recorded any difference greater than three plants per 10 ft. may be regarded as significant. The increased germination of Treatments 2 and 3 over Treatment 1 is unusual and difficult to understand. In regard to the yield-figures there are no significant differences.

Experiment B.

This plot was sown down on 21st November, 1928, germination counts being taken on 21st December, and weighings made on 18th and 20th June, 1929. Treatments per acre and field germination and yields are given in Tables 12 and 13 respectively.

Table 12.

No	Treatment per Acre.	Rear Box.	Front Box.	Total.
		Cwt	Cwt	Cwt
1	Super 3 cwt. + lime 3 cwt	..	6	6
2	Super 3 cwt + lime 3 cwt . ..	½	5½	6
3	Super 3 cwt + lime 3 cwt	1	5	6
4	Super 3 cwt + lime 3 cwt	2	4	6
5	Super 1½ cwt + Ephos 1½ cwt. + lime 1½ cwt.	¾	3¾	4½
6	Super 1½ cwt + Ephos 1½ cwt. + lime 3 cwt.	1	5	6

Table 13.

No.	Treatment.	Average Number of Plants per 10 ft Row (100 Counts).	Yield in Tons per Acre.
1	Super + lime	35·3	11·4
2	Super + lime	32·6	11·9
3	Super + lime	34·8	11·3
4	Super + lime	31·9	11·6
5	Super 1½ cwt + lime 1½ cwt + Ephos 1½ cwt	38·7	11·2
6	Super 1½ cwt + lime 3 cwt + Ephos 1½ cwt.	31·2	11·4

Each yield given in Table 13 is the average of thirty-three weighings of two rows by ½ chain. In the germination figures any difference greater than three plants per 10 ft. may be regarded as significant. The reasons for the differences in germination which occur are inexplicable, and seem to point to irregular sowing. This is a point which will be investigated during the present season. No significant differences are recorded in regard to yield. Club-root proved bad throughout the plot, thus affecting the yield.

Experiment D.

Sown down on 22nd November, 1928, germination counts were taken on 21st December, and the crop harvested on 18th and 20th June, 1929. Table 14 gives the treatments per acre.

Table 14.

No.	Treatment per Acre	Front Box.	Rear Box.	Total.
		lb.	lb.	Cwt.
1	Super 3 cwt	56	280	3
2	Super 3 cwt. + lime 3 cwt ..	112	260	6
3	Super 3 cwt + lime 3 cwt + 30 per cent. potash 1 cwt	131	653	7
4	Super 3 cwt + lime 3 cwt. + potash 1 cwt. + dried blood 1 cwt	149	747	8
5	Super 3 cwt. + potash 1 cwt ..	75	373	4

Results of field germination and yields were as follows:—

Table 15.

No.	Treatment.	Average Number of Plants per 10 ft. Row (100 Counts).	Yield in Tons per Acre
1	Super	36·6	29·5
2	Super + lime	38·2	29·2
3	Super + lime + potash ..	41·0	29·3
4	Super + lime + potash + blood	35·3	31·2
5	Super + potash	25·5	28·6

In this experiment each yield is the average of sixty weighings of one row by ½ chain. In the germination figures any difference greater than 2·8 plants per 10 ft. may be regarded as significant. The increased germination of Treatment 3 appears to be abnormal, and may be accounted for by uneven seeding. It is obvious that too much reliance cannot be placed on germination results. The only difference in yield is in the increase due to the use of dried blood (Treatment 4) Potash appears to have had no effect (compare with effect in Experiment D on swedes). On this plot only a slight trace of club-root and dry-rot was present.

Mangel Manurial Trial (Block 8).

Block 8 was devoted to a mangel manurial trial, with the object of determining the effects of various manures on yield, and to obtain some indication as to the possibility of such manures affecting the germination of mangel-seed. The plot was sown down on 4th November, 1928, and germination counts were taken on 20th December The crop was finally weighed on 10th, 14th, and 17th June, 1929. The land is of a heavy clay-loam nature, previously in grass for a considerable number of years. The variety of mangel sown was Webb's Prizewinner, and the rate of seeding 4 lb. per acre. Each plot consisted of two rows, there being twelve replications of each treatment.

On the day preceding sowing alternate strips of agricultural salt were sown in 16 ft. widths at the rate of 3 cwt. per acre, there being five strips with salt and five without. These were sown at right angles to the manurial treatments. The following treatments were given:—

Table 16

No.	Treatment per Acre.	Rear Box.	Front Box	Total.
		Cwt	Cwt.	Cwt
1	Super 4 cwt	1	3	4
2	Super 4 cwt + 30 per cent potash 1 cwt	$1\frac{1}{4}$	$3\frac{3}{4}$	5
3	Super 2 cwt. + Ephos 2 cwt ..	1	3	4
4	Super 2 cwt. + Ephos 2 cwt + potash 1 cwt.	$1\frac{1}{4}$	$3\frac{3}{4}$	5
5	Super 2 cwt + Ephos 2 cwt. + potash 1 cwt. + nitrate of soda (top-dressed later)	$1\frac{1}{4}$	$3\frac{3}{4}$	5 cwt. + nitrate of soda.
6	Super 4 cwt	$\frac{1}{2}$	$3\frac{1}{2}$	4

NOTE.—The nitrate of soda was top-dressed on 18th December at the rate of 147 lb. per acre.

Field germinations were as follows:—

Table 17.

No.	Treatment.	Average Number of Plants per 10 ft Row (108 Counts).	Relative Germination
			Per Cent.
1	Super	43·9	87
2	Super + potash	43·3	86
3	Super + Ephos	49·2	98
4	Super + Ephos and potash ..	45·6	90
5	Super + Ephos + potash + nitrate of soda after counting	42·3	84
6	Super	50·5	100

In regard to the germination figures, any difference greater than 4·5 plants per 10 ft. is significant. An amount of 1 cwt. per acre of super used in contact with the seed has reduced the number of plants by 6·6 per 10 ft below the number growing when only $\frac{1}{2}$ cwt. of super was sown with the seed. Treatments 3 and 6 have the same amount of super sown with the seed—namely, $\frac{1}{2}$ cwt. per acre, and show germinations practically equal. Treatment 4 is not significantly lower in number of plants than Treatment 3, although Treatment 5 is lower. Taking Treatments 4 and 5 together the germination injury due to potash becomes significant, although its effect is not apparent when Treatment 2 is compared with Treatment 1. As a result of this trial it would appear that mangel-seed is susceptible in small degree to germination injury by manures of a soluble nature.

Table 18 shows the yields obtained as a result of the various applications of fertilizers, each yield being an average of fifty weighings of two rows 16 ft. in length.

Treatments 5 and 6 gave significantly better yields when used on ground treated with salt than where no salt was used. Treatments 1, 3, and 4 show increases due to salt, though not to a significant extent. Treatment 2 (super + potash) has given a significantly better yield when used without salt than with it.

Table 18.

No	Treatment per Acre.	Yield per Acre.		Difference in Favour of Salt.	Significant (S.), or Non-significant (N S).
		With Salt.	Without Salt.		
		Tons	Tons.	Tons.	
1	Super	24·7	23·4	1·3	N S.
2	Super + potash	23·2	24·2	1·0	S.
3	Super + Ephos	26·4	25·0	1·4	N S.
4	Super + Ephos + potash ..	24·4	23·5	0·9	N S
5	Super + Ephos + potash + nitrate of soda top-dressed	26·2	25·0	1·2	S
6	Super	28·9	26·5	2·4	S.

The yields of Treatments 2 and 4 are significantly lower than those of Treatments 1 and 3 respectively on salt-treated ground. Without salt Treatment 4 is significantly lower in yield than Treatment 3, but Treatment 2 does not differ significantly from Treatment 1. Hence potash has depressed yield in three out of four comparisons. Treatment 5 is significantly better than Treatment 4 on salted ground. The same treatments on unsalted ground show a barely significant difference. It is fairly safe to conclude that nitrate of soda has caused a slight increase in yield, although it has only just compensated for the depression due to potash. It will be noticed that Treatments 3 and 5 are practically the same in yield. Treatment 6 has given a significantly better yield than all the others. Consequently it appears that there is a fairly low limit to the amount of soluble fertilizer which should be applied in contact with the seed on this class of soil.

From the foregoing experiment it will be noticed that mangel-growing can be considered as a payable proposition on country similar to that where the experiment was conducted. In view of the fact that club-root and dry-rot are proving such a serious drawback to the growing of turnips and swedes, it would appear that more consideration should be given to the growing of mangels on ground thus affected.

Potato Manurial Trial (Block 4).

A manurial experiment on potatoes was conducted on this block, with a view to ascertaining the effectiveness of various fertilizers when sown with the crop. The experiment was planted on 2nd October, 1928, on soil of a heavy clay-loam nature, and dug on 2nd, 3rd, and 4th May, 1929. Six replications of each treatment were carried out, and yields as shown in Table 19 were obtained.

Growth throughout was quite good, and, as will be observed from the yield figures, the effect of sulphate of potash considerably increased the yield. It would thus appear that in this Gore soil-type potash is a limiting factor in so far as the growing of potatoes is concerned. Before weighing it was very noticeable that the haulms in Treatments 4 and 5 were much denser than in other treatments. The potatoes lifted from those rows so treated were of a decidedly better quality and size. Two lines of seed were used in this trial, one being certified Arran Chief from Canterbury and the other a locally grown line of Arran Chief containing a fair proportion of Northern Star rogues.

Table 19.

No.	Treatment per Acre.	Yield per Acre.			Total.
		Table Size.	Seed Size	Small Size	
		Tons.	Tons.	Tons	Tons.
1	No manure	1·2	1·3	3·2	5·7
2	Super 3 cwt	1·2	1·2	3·2	5·6
3	Super 3 cwt + sulphate of ammonia 1 cwt	1·3	1·3	3·5	6·1
	The above yields do not differ significantly from one another.				
2	Super 3 cwt.	1·2	1·2	3·2	5·6
4	Super 3 cwt + sulphate of potash 1 cwt	3·0	2·3	3·3	8·6
	Significant increase of No 4 over No 3	1·8	1·1	..	3·0
4	Super 3 cwt + sulphate of potash 1 cwt	3·0	2·3	3·3	8·6
5	Super 3 cwt + sulphate of ammonia 1 cwt + sulphate of potash 1 cwt.	2·8	2·5	3·9	9·2
	Significant increase of No. 5 over No 4	..	..	0·6	..

Club-root Trials (Block 4).

The incidence of club-root in turnips in Southland has in the past been of such a serious nature that turnip-growing in certain districts has become a most precarious undertaking. Despite frequent applications of lime to the soil in which turnips are grown this disease still causes great annual loss, and consequently every step is being taken to ascertain some effective method of reducing the damage so occasioned.

An interesting trial was conducted on the Area during the past year, consisting of a test of varieties of swede turnips reputed to be highly resistant to club-root. Two Danish varieties were put under trial, these being separate strains of Bangholm Purple-top swede—namely, Herning and Hunsballe VI. These two strains of Bangholm swedes were compared with two standard commercial varieties commonly grown in Southland, designated in this record Commercial A and Commercial B. Seed of the four varieties was sown in plots 2 chains in length, each plot consisting of four drills of each variety. The plots were replicated twelve times. Prior to sowing on 24th November, 1928, the seed of each variety was treated by the Department's Field Mycologist for dry-rot, and sown at the rate of 1 lb. per acre.

Although no germination counts were taken, a good even germination occurred with each variety, there being no visible differences to record. From the time of germination until the beginning of January growth throughout proved fairly even and regular. At the time of thinning, however, during the middle of January, it was noticeable that each variety of swede was badly infected with club-root, with the exception of the Herning strain. At the beginning of February each of the varieties had completely died out with club-root, with the exception of Herning, which continued to grow vigorously. Only a

few isolated plants of the remaining varieties remained, forming a striking contrast to the dense rows of well-grown Herning bulbs.

A final examination of the block was made on 22nd May, 1929. By this time Herning was the only variety left growing, and a close examination was carried out to ascertain the percentage of club-root and dry-rot infection present. Of 741 roots examined 145 proved to be infected with club-root and 313 infected with dry-rot. The yield from the crop of Herning was estimated at 26 tons 13 cwt. 3 qr. per acre, whereas no yield was obtained from the other varieties.

In view of the fact that this trial was conducted on land heavily infected with club-root, there is ample evidence that the Herning strain of Bangholm Improved Purple-top swede is highly resistant to the disease. It is not immune, however, from club-root or dry rot. There can be no question that this particular variety is a most valuable one for Southland conditions, and further trials in regard to its disease-resisting capacity are being arranged It is of interest to record that in a trial of eighteen varieties of swedes conducted at Tapanui Herning gave the second highest yield, proved of good keeping-quality, and was well liked by stock.

Effect of Lime on Crops (Block 7).

Block 7 is being utilized for an extended trial of the effect of lime on various crops extending over a number of years. No report on this experiment, however, will be given until the completion of the trial.

Green Manuring with Lupins (Block 5).

For the purpose of improving the soil conditions and fertility of Block 5, a crop of blue lupins was sown in the spring and ploughed in during January. The crop was drilled at the rate of 2½ bushels, together with 2 cwt. of super, per acre, and grew excellently. The practice of ploughing in a crop of lupins on one block each year will be continued.

Acknowledgment is made of the excellent service rendered by the Overseer, Mr. J. Sleeman, and to the Crop Experimentalist for assistance and advice in connection with the various experiments.

Separation of Milk at Varying Temperatures.—During the 1928–29 season a series of experiments was carried out by the Dairy Research Institute, at Palmerston North, to determine the effect of separating milk at low temperatures and to ascertain whether the usual loss of butterfat at such temperatures can be economically avoided. The annual report of the Director of the Institute states: "It was shown that at temperatures of separation below 80° F. the loss of fat is fairly considerable, but not sufficient to merit the employment of expensive methods of heating. It was also shown that at low temperatures of separation the cream test was increased. Further, the experiments prove that the loss is greatest when the cows are far advanced in their lactation period. Hence the time at which farmers need to pay very particular attention to the temperature of their milk is towards the close of the dairying season, when cows are nearing the end of their lactation and atmospheric temperature is below normal"

SEASONAL NOTES.

THE FARM.

The Pastures.

IN February mowing of pasture may be advisable because of one or more of several sets of circumstances. Thus it may be necessary to remove the flower-heads of perennial weeds, or it may be advisable to "top" portions of pasture-growth which are rank and producing seed, in order to induce the development of fresh growth from the base of the topped plants. Sometimes pastures are overrun with large numbers of shade-creating weeds such as spear-thistles, docks, fat-hen, and redshank or willow-weed. If these weeds receive no attention they are likely to greatly weaken the pasture plants in their immediate vicinity, and possibly create vacant patches on which inferior plants may become established. If, however, they are mown they cease to create the shade which injures the valuable pasture plants.

Over a wide range of conditions some at least of the grassland on farms may well have phosphates applied in February or thereabouts. When the soil-moisture is sufficient the application of phosphates at this period stimulates extra valuable fresh growth, and the phosphates will continue their stimulation of the grass during the following spring, so that a grass-growth more even over the whole year results.

The preparation of the ground for autumn sowing of pastures is an important summer task. A good seed-bed for this purpose is fine and firm. These characters, and particularly firmness or consolidation, cannot be secured readily unless the work is commenced in good time. Clovers, which are vital to successful permanent pasture, call particularly for consolidation. The value of a firm seed-bed is well exemplified in the fact that the best pastures are often to be found round the headlands, where there has been the greatest amount of consolidation by the passage of horses and implements.

There is being enacted a silent revolution in the matter of determining the ingredients of pasture-seed mixtures. For generations the natural plant-food supply of the soil has been a prime consideration when deciding upon a grass-seed mixture. Now that the farmer has available the wide field of pasture top-dressing as a handmaid, the ingredients of a seed mixture may be determined not so much by the initial fertility of the soil as by the rainfall it receives. In brief, it is often proving more profitable to bring the fertility of the soil up to the requirements of a high-class seed mixture by suitable top-dressing, rather than to frame a seed mixture with requirements down to the natural unimproved fertility of the soil. In conformity with this policy, land the fertility of which is better fitted to the requirements of cocksfoot than those of perennial rye-grass may nevertheless, on sound lines, be given a mixture suited to develop a rye and white clover dominant pasture, there being an underlying intention to bring the fertility up to rye-grass requirements by suitable top-dressing. Because of this change in outlook seed mixtures which were considered the best a few years ago for certain conditions may not now be so considered. Farmers who desire to keep abreast of recent developments in this connection may find it worth while to seek the advice available from local officers of the Fields Division of the Department of Agriculture.

In districts subject to grass-grub depredations it is advisable to avoid the sowing-down of pastures after a cereal or previous crop of grass; the less plant-covering land carried during the November to January period the more likely is it to be free from the grub.

A February Feeding Weakness.

In some of the most favoured dairying districts the daily butterfat production of February is in normal seasons only about 75 per cent. of what it was in December. It is not natural for cows, even animals which are not of particularly good dairy type, to fall off in production at such a rapid rate, and in such cases it can be taken that there is something wrong with the management. Investigation has disclosed that it is the feeding that is at fault. The weakness is usually not so much one of deficiency in quantity as deficiency in quality—there is usually an ample supply of feed of a sort, but it is not of the type which begets efficient butterfat-production Usually there is too low a proportion of the class of essential substances known as proteins, which cannot be replaced by an oversupply of other classes of nutritive substances. Frequently also the feed is not sufficiently digestible to secure the best production from dairy cows. If cows given feed of this type are at all inclined to beef, they will immediately commence putting fat on to their frames rather than into the bucket. They will be condemned, when it is the feeding of them which should be condemned. Conditions which favour body-fat production rather than butterfat-production occur when the animals are being fed pasture that is too long and mature, or overmature special forage crops such as maize and millet, or ensilage saved from grass that was cut when it was too mature. In all these cases a feed badly balanced for butterfat-production is being provided. It can be taken that once flower-stalks have developed on any one of the crops mentioned, that crop is beyond the best stage of feeding for butter-fat production. The badly balanced feeding can be avoided in February primarily by keeping the pastures short and leafy.

Other very useful February measures are the feeding of young succulent lucerne or red clover before it has developed much woodiness and before there is any flower-production, the feeding of young millet, and the feeding of soft turnips. Some of these crops would produce heavier yields possibly by leaving them longer unutilized, but by so leaving them they would provide either a badly balanced forage or one not so greatly needed when the time comes to use it.

The Breeding-ewes.

In the North Island farmers who propose to raise fat lambs usually put out the rams at the end of February or early in March. If there is a likelihood of the ewes being too fat they should be put on short rations early enough to have reduced their condition sufficiently. Flushing the ewes for a week or ten days before the rams go out is of value. Flushing can be effected by providing some succulent food, such as rape after the first feeding-off of the lambs, or by putting the ewes on the best short pastures available.

Seasonable Forage-crop Work.

Valuable work in connection with forage-crop production can, if necessary, be carried out during the coming few weeks. In many localities there is still time to sow turnips. Imperial Green Globe, Hardy Green Globe, and White Stubble turnip are generally suitable for sowing at this time. Swedes are less satisfactory for late sowing partly because of greater possible ravages from the insect pests, especially should a dry autumn occur. There will, in many instances, be available vacant land which offers splendid opportunity for the growing of forage which would become available during times of possible shortage. For instance, land in oat stubble, if worked as soon as the crop is removed and then sown in Western Wolths rye-grass and red clover, will provide autumn and winter feed which is often quite valuable, especially to sheep-farmers operating under Canterbury or similar conditions. Black Skinless barley sown at the rate of 2½ bushels per acre develops so quickly that it will provide good feed for dairy cows or sheep in about eight weeks. Often it can be suitably sown immediately after

oats, and if sown in February provides feed at a time when it is often desired. Algerian oats are very useful for later sowing and later use. With all these crops it is usually profitable to apply superphosphate at 1 cwt. to 2 cwt. to the acre.

All crops sown in rows wide enough apart to allow of it call for summer intertillage at regular intervals as long as it is possible to work between the rows. It is impossible to safely say how often the intertillage should be carried out. On soils the surface of which is apt to cake a short heavy beating rain may so solidify the surface as to call for another cultivation, even though a cultivation had been carried out shortly prior to such a rain. The condition to aim at, especially in dry climates, is a continuously loose surface layer of soil.

Lucerne.

Lucerne may be sown with success in February in some districts. Good germination is favoured by the warmth which the soil then possesses. Further, the February-sown crop is likely to escape much of the trouble from certain weeds, such as fat-hen, which at times greatly handicap the establishment of a spring-sown crop. Where the grass-grub is present it is desirable that land to be sown with lucerne in February should have been free from grass or cereal growth during the previous summer period, when eggs of the grub were being deposited.

Young lucerne which was sown in November or December is often fit for mowing in February. It is better not to hasten the mowing, however, unless flowering has commenced or weeds are tending to choke the lucerne-plants, for the early stages of the crop can well be spent in building up sturdiness and a roomy root-system rather than in producing forage.

It is often profitable to top-dress lucerne with phosphates in summer. Top-dressing at this season is much preferable generally to top-dressing in the early spring, which is so often practised, and which is likely to stimulate invading grasses such as rye-grass and cocksfoot—the very plants it is desirable to suppress in the interest of lucerne.

Summer Weed-control.

During summer attention can often be given with profit (particularly by those with land under the plough) to certain important matters affecting weed-control. In the first place, certain crops such as mangels, swedes, and potatoes, which are sown in rows wide enough apart to admit of intertillage, have been called "cleaning" crops, because of the possibilities they provide of getting rid of weed infestation. It is highly desirable that these crops be made "cleaning" in fact as well as in name. Too often they are cleaning-crops in name only, because once the main invasion of weeds has been eliminated little attention is given to succeeding invasions, which, even if they do not seriously lessen the yield of the crop, are usually quite sufficient in numbers to foul the land badly if they are allowed to produce seed. February is a time when there is often neglect in this respect.

At times, and particularly in the South Island, weed infestation should be considered when future cropping is being planned. For instance, land may be known to be foul with annual weeds such as fat-hen, spurrey (yarr), and night-shade, which germinate in the spring rather than at other times. Cropping should be arranged so that such land will be sown in the autumn rather than in the spring. The influence of the date of sowing on weed-control is well exemplified when wheat is grown on land infested with fat-hen seeds; the fat-hen will not be much in evidence in autumn-sown wheat, whereas it is likely to be prominent in and to seriously affect the returns from spring-sown wheat. Again, turnips or spring-sown oats may be almost completely ruined by spurrey, whereas autumn - sown oats or temporary pasture on the same land may be expected not to be seriously affected by this weed. It is well to bear in mind, further, that if trouble from annual

weeds is avoided for one season, in the manner just mentioned, the land does not, merely on that account, become free from weed-seeds; the seeds of certain weeds, among which are fat-hen and spurrey, are capable of continuing alive and vigorous even when buried in the ground for many years. Because of this, land on which seeds of such weeds occur in profusion should be kept in pasture (if the pasture is a satisfactory one) as long as requirements do not call for its being put under the plough.

There is another aspect of weed-control calling for consideration at the present season. It has to do with summer fallowing, which was once generally recommended as a standard means of weed-extermination. Except under the conditions most favourable to it, which are not of wide occurrence, it is now being dispensed with, because it is impracticable as a sole means of destroying weeds difficult to deal with. The summer fallow was usually adopted against weeds of the "twitchy" type, such as sorrel, couch-grass, yarrow, brown-top, creeping fog, and Californian thistle. It is now accepted that, while summer fallow may at times eradicate weeds of this type, the method requires so much labour as to become too expensive; and, further, under many conditions, no matter how much labour were devoted to summer fallow, by itself it would not be effective.

This is not to say that summer cultivation is useless in weed-destruction. The position is that to obtain its full potential value it must be linked with other suitable measures of management—measures which continue to exert on the perennial twitchy weeds a weakening influence similar to that exerted by the cultivation. For instance, summer cultivation during a dry period should be followed by the immediate sowing of a crop which grows quickly and densely. These crops have a smothering effect by excluding direct sunlight, which is a vital necessity to practically all weeds. At times autumn-sown Algerian oats, or Western Wolths rye-grass and red clover, prove suitable for this purpose. If after such crops the weeds still call for attention it can often be given effectively by growing a well-tended, well-nourished forage crop such as mangels, turnips, rape, or chou moellier In brief, a suitable rotation which is spread over a number of seasons, and which all the time pays its way, rather than expensive summer fallow, is the modern method of perennial-weed eradication.

Another point often overlooked in regard to weed-control is that soil the surface of which is badly infested with weed-seeds, having been ploughed, should then be so cultivated that the buried former surface layer is not again brought to the surface. Weed-seeds buried to a depth of some inches, while they may not be destroyed, will be dormant, and so long as they remain dormant they are of no moment to the farmer. This point is of considerable importance in planning cropping programmes in which crops such as mangels, lucerne, and carrots figure These crops are specially apt to suffer badly from weed infestation, and ploughing for them should be planned with this point in mind.

Often direct attack on weeds such as sorrel, brown-top, creeping fog, and similar "twitchy" plants is not advisable. The best mode of dealing with them is often to sow the land in grass, and by judicious manuring and management to make the conditions so favourable to growth of grass that the grass gradually smothers the weeds to such an extent that their presence is not felt.

The matters in regard to weed-control calling for attention at the present season, summed up, are (1) the taking of proper steps to make "cleaning" crops true to name; (2) the adoption of a suitable rotation rather than summer fallow to eradicate perennial weeds; (3) the autumn sowing of land infested with spring-germinating weed-seeds; (4) care not to bring to the surface a crop of weed-seeds that has been buried deeply, (5) the attacking of certain weeds indirectly by making the conditions so favourable for valuable plants that these latter smother the weeds.

—*R. P. Connell, M.A., Fields Division, Palmerston North.*

THE ORCHARD.

Spraying.

CODLIN-MOTH control measures must be continued during the coming month, but with varieties approaching picking consideration must be given to the possibility of spray residue being in excess of the export tolerance, or remaining in sufficient quantities to detract from the appearance of the fruit for local market. A flight of moth may be expected early in January, necessitating another lead spray. To spray or not to spray is a question that always confronts the grower as the crop approaches maturity, and the decision must be with the individual orchardist, after due consideration of the length of time prior to picking, weather conditions, prevalence or otherwise of black-spot, &c. The omission of spreader and Black Leaf will assist in reducing the amount of deposit, and if a combination lime-sulphur and lead is used any excess of lime should be avoided.

Apples and pears will be kept under close observation, particularly during humid spells following showers for the first appearance of fresh black-spot, either on foliage or fruit, and if circumstances permit a spray should be applied immediately. Where powdery mildew is in evidence precipitated sulphur at 10 lb. or 12 lb per hundred gallons will be required, and should not be neglected, for this disease may seriously debilitate the tree, making the production of satisfactory crops impossible. Another arsenate-of-lead spraying may be necessary for leech.

Silver-blight (silver-leaf) infection in stone-fruits should receive attention during the early summer months Removing the infected limbs during the growing season simplifies the detection of the disease and increases the possibility of recovery where the infection is slight. Innumerable weird and fantastic remedies or cures for silver-blight have been given publicity from time to time in all parts of the fruitgrowing world, but so far nothing has proved superior to the removal of the infected portion. Isolated cases occur where trees recover without treatment, but they are the exceptions, and where the infection is general it is advisable to dig up and burn all infected material before the spores are liberated to infect surrounding trees. The three summer months are considered to be the period of least susceptibility, and during that time the upward flow of sap tends to form a gum barrier under the exposed surface and retard or prevent reinfection. After any cutting-out operations precautions should be taken against infection from spores, which appear to be always present in the atmosphere. For this purpose any good lead paint or grafting-wax will be suitable. Similar steps should be taken with limbs which have split or broken through heavy cropping, and timely attention may be the means of saving the tree.

Picking for Export.

Export picking will soon commence in earnest, and once started there is no easing up until the season is finished. Each season seems to find some grower short of necessary requisites, and annoying delays, sometimes detrimental to the fruit, are often caused through lost stamps, damaged wiring-machines, or repairs to equipment which should have received attention during the off season. Delays in picking consequent on shortage of orchard cases are frequent causes of damaged fruit. In their efforts to maintain a fair daily average pickers will be tempted to remove the fruit and empty the picking-bags with more haste than discretion, and the size of the cull heap will tell its own tale. Not infrequently it is possible to locate the pickers from a distance by the rattle of the fruit being shot out of the bags into the cases, and as many more bumps are inflicted before the fruit reaches the consumer it is not surprising that it does not always open up in the best condition. The successful organization of an orchard

team is often no small undertaking, and the practice of making each picker chalk a distinguishing mark on each of his cases as they are filled helps to eliminate slipshod methods and place credit where it is due. The picker carries a responsibility that is not fully appreciated, and any one lacking aptitude should be transferred to another job.

Just what stage of development and what conditions to look for as an indication of the correct degree of maturity for storage purposes are always perplexing questions, which can only be satisfactorily decided by familiarizing oneself with the individual variety and its peculiarities. If the requisite degree of maturity has not been reached, certain chemical changes which cannot continue after the fruit has been picked will be arrested, and the result will be an insipid specimen of sponge-like texture. On the other hand, if allowed to remain on the tree until fully ripe the fruit, having a definite length of life, has reached its zenith, and with the decline its storage life is correspondingly shortened Of the apparent changes which take place none can be relied on individually. The development of the red in coloured varieties and the fading of the green to yellow in others may be accelerated or retarded by unfavourable weather conditions. The pips may be quite brown while the juice is milky, indicating that the transformation of starch to sugar has not advanced sufficiently and consequently that flavour is lacking. The degree of resistance in removing the fruit from the spur is governed by the progress of the formation of the abscessial layer (a growth of tissue between the stem and the spur, designed to check further development and facilitate the transference of the seed to its natural element), and if the fruit with stem intact does not separate readily it is obvious that picking should be delayed.

Taken collectively these conditions can give a fairly accurate indication of the progress of maturity, and where quality and flavour are the first consideration picking should not commence until some flavour is noticeable, but before any softening takes place, otherwise the keeping-qualities will be sacrificed. To ensure making an even line several pickings are necessary, usually the tops of the trees and the more exposed portions providing the first fruit, the remainder ripening at a slower rate. It is important that fruit should be dry when picked, and picked fruit should be stacked in the shade to hasten colouring.

Grafted Trees and Budding.

Grafts will now have attained some size, and may need staking as a protection against March gales. Undesirable shoots may be pinched out to shape the tree, and adventitious growths coming from the stock may be gradually removed. Where grafts have missed, buds may be inserted in a suitably placed sucker.

Budding may be pushed on while the stocks are active. If dry weather has prematurely checked the sap-flow, rendering the bark hard and difficult to lift, it may be advisable to delay the operation until early rains stimulate growth prior to leaf-fall. Last year's buds may be shortened to a desirable height to induce branching. Peaches and nectarines will make a considerable amount of growth from now on, and if the leading shoots are pinched back occasionally to check the growth a better type of wood will be produced.

Cultivation and Cover Crops.

Growth will be reaching a stage where in many places cultivation will have to be suspended. While the land is in good physical condition it is sound practice to take advantage of the good tilth and sow a cover-crop, either for grazing off or ploughing in with the spring cultivation. Continued clean cultivation is not in the best interests of the land, for the time must come when, through the depletion of the humus content and the attendant changes in the nature of the soil, fertility is reduced, full value

is not received from the application of artificial manures, and there is a corresponding decrease in the vitality and productivity of the trees. The choice of cover-crops will be governed by the ultimate requirements and the nature of the land Leguminous crops are generally preferable, and where a large bulk of matter is required blue lupins find most favour. Other suitable crops are oats and vetches, field - peas, cape barley, and mustard.

Summer Pruning.

While impracticable in most mixed commercial orchards, summer pruning can often be advantageously resorted to during the midsummer period. Pinching back the strong shoots and thinning out the weedy undesirable or crowded growth will assist in promoting better development of the permanent wood and the fruit-buds for next season's crop.

Citrus-culture.

As fruit reaches picking size it should be harvested to reduce the strain on the trees. With the driest period of the year approaching every assistance should be given to the trees to maintain their vigour, for anything approaching drought conditions may produce wilting, defoliation, dropping of fruit, and inability to continue growth with the advent of autumn rains. Frequent surface stirring will aid materially in conserving moisture and eradicating weeds which compete with the trees for the available moisture. Mulching with any suitable material will assist in keeping the surface cool and retard evaporation.

Young trees will be benefited by occasional inspections to suppress any undesirable shoots while they are soft, particularly those which arise from the lower part of the stem and develop into secondary leaders. Too little attention is usually given to laying in the foundation limbs of young lemon-trees, and in later years the trouble cannot be rectified without sacrificing valuable fruiting-wood. As opportunity offers bark-diseases should receive attention, and any injuries inflicted during cultural operations should be painted over. Very frequently these injuries provide entry for fungus organisms, and the infection area may become extensive before the effect is apparent

—*G. H. McIndoe, Orchard Instructor, Gisborne.*

POULTRY-KEEPING.

Priming the Cockerels.

Now that the young stock are developing at a rapid rate the demand for housing accommodation will be increasing daily, with the possible risk of the birds becoming overcrowded. To lessen the risk of this and its evil effects, particularly on the growing birds, the necessity for priming-off all forward cockerels must be emphasized. Even when food is cheap it is false economy to keep a cockerel after it is about five months old, but with food at its present high price a bird may easily show a loss instead of a profit. Another point to be remembered is that the flesh of a prime five-months-old bird is distinctly superior to that of one double that age, and will therefore command a much higher price and give a better return over the cost of production. The great advantage, however, in weeding out cockerels at an early age is that accommodation and runs are saved, which is distinctly to the advantage of the remaining stock, while more time is available to attend to the main working of the plant.

It is a mistake to endeavour to prime cockerels when they are running with the pullets; the males should be separated from the females before they commence to crow. Nor should one try to prime cockerels on inferior

or damaged food; if they are to lay on flesh rapidly the food should be sound and fed with a free hand The birds should be confined in small runs with little scope for exercise, and only soft food should be given, as hard grains are apt to bring on digestive troubles when the birds are confined to a limited space. A suitable mash may be made from two parts of bran and one part each of finely ground wheat-meal and maize-meal, the whole being moistened with milk or soup and mixed into a crumbly mash. Feed three times a day as much as the birds will eat up clean. Succulent green food can be fed in abundance, but separately, and where skim-milk is available it may be given in large quantities for drinking.

High Perches and Foot Troubles.

It is often difficult to impress the fact that it is a mistake to have perches in the house unduly high, and that to compel birds to roost on high perches is one of the chief causes of disorders of the feet, especially corns. It is argued that when a fowl is allowed its freedom to roost where it likes it will fly into high trees and come down again without injuring its feet. The fact is overlooked that out in the open the bird can spread itself in a natural manner, and is therefore able to land gently on the ground, running as it alights to break the force of landing In the fowlhouse, on the other hand, the bird loses all the advantage of its wings in its descent, and on reaching the ground the whole weight of its body has to be borne by the legs

The hard landing not only has the effect of injuring the feet, but also has a detrimental effect on the high-type layer in the flush of her laying-period. Every care should also be taken to prevent breeding-pen cocks from contracting corns, as generally if they become affected in this way a high percentage of infertile eggs will be the result. While high perches and a hard floor to alight on are frequently a reason for corns, it must not be inferred that a floor such as concrete is a mistake from a health point of view. Concrete is an ideal flooring-material, but the perches should not be higher than 15 in., and there should be ample litter to provide a soft landing-place when the bird is alighting from the perch. When a bird becomes affected with a corn and is considered to be of sufficient value to receive personal attention, painting with iodine is a simple and often effective treatment. Another method is to treat with a bluestone solution. Dissolve a piece of bluestone about the size of a walnut in half a pint of hot water, and when the solution is cool dip the affected foot into it, repeating this treatment daily for a week or more

Many poultry-keepers lance the foot immediately a corn is detected. This is not only a cruel practice, but it seldom has the desired effect. The corn or abscess should not be interfered with until it has reached a perfectly ripe condition, and at this stage it will probably make its appearance between the toes as well as on the ball of the foot. From these places the dry pus can be easily picked out by means of a small-bladed penknife. After this operation a few drops of peroxide of hydrogen may be dropped into the affected parts. In order to keep the wound clean the foot should be bandaged and kept soft with vaseline or a similar preparation. The bird should not be allowed to perch, and should be provided with soft bedding until a cure is effected

As is the case with most troubles affecting poultry, the best method of dealing with corns and other disorders of the feet is to prevent them, the chief essentials for which are low perches, a well-littered floor, and eliminating undue pressure on the feet by keeping the birds as far as possible from running on hard stony ground.

Marking Chickens.

Poultry-keepers should on no account fail to mark the young stock as a future guide to age, in order to distinguish the young birds from the old

ones when culling is necessary, which is the case every season if only profitable birds are to be retained. There are practically no definite means of telling the age of a bird by its general appearance. Perhaps the simplest method of marking birds is to punch a hole in the web of the foot, keeping a particular section of the web of each bird for the particular season. It should be remembered that even in the best of flocks the egg returns from the second-season birds are at least 30 per cent lower than from the pullets, while the cost of production is just the same, and the yield decreases more rapidly after the second year This necessary detail should therefore not be delayed. It is the only safe means of obviating the common mistake of sending a young profitable bird to market and retaining an old and unprofitable one. A punch for the purpose can be obtained at a moderate price. With this instrument the young birds can be marked at an early age, or even when leaving the incubator. For marking fully developed birds, rings, as commonly used in a pig's nose to keep it from rooting, are quite effective. These are obtainable in both the round and flat form. They may be easily put on the leg of a fowl with a pair of closing-pincers as used for ringing a pig, and when once on there is little or no chance of them falling off. For pedigree breeding the flat rings may be numbered by means of a small set of steel numbering punches.

Hens losing Feathers from Back.

A correspondent asks for advice regarding some of his hens losing the feathers from their backs. This condition is found only where the hens are running with male birds. It need not cause any anxiety, as the bare places will soon feather over when the cocks are removed from the pen. It is always the best layers which become the worst affected in this way, and particularly where the birds are overmated on the male side, or the latter are specially vigorous.

Now that the breeding-season is over the importance of separating the breeding-males from the females must be strongly emphasized. More eggs will be produced without the males, while from all points of view the separation will be to the advantage of the females.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Extracting Operations.

If the bees have received adequate attention, and have been supplied with sufficient super-accommodation, there should be some honey fit for extracting before the end of January. At that time there will still be a flow of honey, however, and consequently more or less unripe honey in the hives. It will therefore be necessary to make a point of seeing that any combs taken from the hive for extracting purposes are sealed.

Escape-boards are sometimes a convenience in taking off honey for extracting. Boards made for the greater part of wire cloth are preferable, as they permit of the warmth from the bees rising to the honey; such boards are obtainable from dealers in beekeepers' supplies. It will be necessary to see that there is no brood in the combs above the escape-board; the bees will not go down if any of the combs contain brood. If the boards are inserted late in the afternoon all the bees will have gone down to the brood-chamber before the following morning, and the honey can be taken off without disturbing them.

When taking off honey keep a sharp lookout for signs of foul-brood. The honey from diseased colonies should not be put through the extractor until all other extracting is finished. The combs from infected colonies should be destroyed after the honey has been extracted.

As previously mentioned, the beekeeper should make sure that the honey is well ripened before removing it. The usual method of removal is to take out the combs one by one, giving each comb a sharp shake to dislodge as many bees as possible, and then each side a light brushing to remove those remaining. The frame of honey is then placed in an empty super or hive-body on the barrow, and taken to the honey-house. This method allows the combs to be examined, so as to reject any containing brood. But where queen-excluders have been in use the plan is usually to remove the queen-excluder the previous evening, slipping in its place a bee-escape board.

When sufficient honey has been removed to keep the extractor going for some time it is advisable to commence operations at once, while the honey is warm. Nearly all up-to-date apiaries are now equipped with a steam-heated uncapping-knife and capping-melters. There is no doubt that the use of these greatly facilitates the work of extracting.

Provision should be made to allow the honey to run from the extractor or pump through a strainer before it reaches the tank. It is a good plan to have a fairly coarse strainer on top to catch the larger particles of wax, and beneath it a finer one. For the lower one cheese-cloth answers the purpose very well. These strainers should be removed when necessary and washed in cold water, then given a good shake to remove the small particles of wax, and allowed to dry before again using.

From the strainer the honey should be run into tanks in order to allow it to settle, and the small bubbles of air and particles of wax that have escaped the strainer to rise to the surface. These should be skimmed off as they accumulate. The size of the tanks is a matter for the beekeeper's opinion, but the tendency now is to have deeper tanks sufficiently large to hold at least one day's extracting. The honey should be left in these for two or three days if the weather is good. Should the weather become damp during extracting the tanks should be kept covered so as to prevent the honey taking up moisture from the damp air. If it is found that the honey on the top is becoming thin it is advisable to skim this off and put it aside. No such honey should be put in packages for the market, otherwise it will probably mean a considerable loss, owing to fermentation setting up through the excessive moisture.

Most beekeepers who have only a few colonies will make use of existing buildings for extracting. It will be necessary, however, to select a building that can be made bee-proof. In apiary work, as well as in all other occupations requiring the handling of foodstuffs, the question of cleanliness must not be lost sight of. Everything in the honey-house should be kept scrupulously clean. The extractor and tanks should be scalded out previous to being used, and as soon as the day's work of extracting is done they should be covered with covers made for the purpose so as to keep out all dust, &c.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

The Tobacco Crop.

THE early crop of tobacco will now, four weeks or so after topping, be approaching maturity, and will soon be ready for harvesting. Ripe leaf slightly droops, is brittle, and mottled with light-green and yellow spots, first on the lower leaves and then spreading to the leaves above them on the stalk.

Where air-curing on the stalk is practised the plants should be cut as soon as the middle leaves are ripe, as these are the more valuable. There should be no delay; every day gained is an advantage, as the warm, dry weather at this season makes a first-rate cure a comparatively easy matter. When this stage is reached the only legitimate cause for delay is wet

weather, as if the plants are cut under or shortly after such conditions the aromatic qualities of the leaf are at a discount. In fine weather, then, as soon as the dew has dried off the leaves, the ripe plants should be harvested by splitting the stalk to within a few inches of the ground and then cutting it off at the base of the plant. The plants are then threaded on the curing-sticks about 6 in. apart and carted to the drying-shed in which they are hung for curing. While awaiting removal they are best hung on a couple of parallel poles on trestles. There they wilt without danger of sun-burning, and will afterwards be handled with less danger of being torn or sweating unduly. Every care should be taken to avoid tearing or bruising the leaf, as such damage is irreparable.

As splitting the stalks has resulted in moulds sometimes developing on the cut surfaces, more especially in humid weather and later in the season, it is now usually the custom to cut the plants off at the surface of the ground, tie the butts of the stalks of the two plants together, and then hang them across the curing-stick. Another alternative method that has the advantage of requiring less shed accommodation is to gather the leaves separately as they ripen. When the bottom three or four leaves are ripe the harvesters break them from the stalk and carefully lay them on trays or a stretcher taken down between the rows, each person gathering the leaves from two rows of plants. These are carried out and tied to the curing-sticks with a cheap cotton twine The leaves are tied in bunches of twos or threes, according to size, by taking a turn round the butts of the mid-ribs with the string and giving them a twist, which leaves them hanging securely first on one side of the stick and then on the other at intervals of 2 in. to 3 in. At the end of the stick the string is tied and broken off; the stick of leaf is then ready for hanging in the curing-shed. The middle leaves and tops are gathered as they ripen. In a well-managed shed this classification is maintained, and half the work of grading the leaf is thus done in harvesting. In the shed the sticks of leaf should hang without touching either those below or the sticks alongside. Careless spacing is a very common fault. It delays the cure, and is often so bad as to cause pole-burn.

Under the warm humid conditions which develop in the shed the leaf first turns a yellow colour, and when this is properly developed it should be thoroughly dried off without delay by increasing ventilation during dry periods. After it has dried out to the extent that the thicker parts of the midrib of the leaf are brittle it should be conditioned by exposing it to a humid atmosphere. It then absorbs moisture and becomes soft and pliable. As soon as this condition is reached it should be properly bulked down in a suitable room. To leave cured leaf hanging in the shed to become alternately dry and moist is bad economy, as it is occupying badly needed space and becoming depreciated in colour and texture, as well as inviting the development of mould along the midrib.

When the separate-leaf system of harvesting is adopted the material may be bulked on the sticks as it is, taking care to maintain the classification of lugs, middle leaves, and tops. Where whole plants are cured the leaves must be stripped from the stalks as soon as they are in condition after drying, and tied into hands of fifteen to twenty leaves, according to the thickness of the midribs. These hands of leaf should then be bulked. When stripping, the leaves should be classified into lugs, middle leaves, and tops, as a preliminary to closer grading, which will require to be done later.

Tomatoes.

Towards the end of February, when the crop of tomatoes under glass has been gathered, the old plants should be lifted and taken out and burnt, for if they remain neglected fungus and insect pests are bred, and infection, which is difficult to remove, develops. When the plants are removed, give light cultivation, and sow the land down in white mustard for a quick cover-

crop, to be followed by another of oats and peas, or by a crop of winter salads or beans. Sometimes a portion of the space is devoted to seed-beds of lettuce, cabbage, cauliflower, &c., for planting out in early spring.

The tomato crop outside will now be maturing, and packing and marketing the crop will keep all hands busy. Standard packing and a system that will ensure even and regular distribution is badly needed. All growers should carefully study these problems now so as to assist their organization to make the requisite improvements. Good progress in this direction was made at the last annual conference of growers, and careful study of problems as they arise this season should enable members to assist in maintaining progress when the opportunities arise in the conference to be held during the coming winter.

Small-fruits.

The suggestions made last month for the treatment of the small-fruit section should still be given attention. Where farm manures are scarce a green crop of white mustard or rape between the rows of raspberries and larger bush-fruits may now be sown with great benefit.

In the South Island strawberries should be planted as early as possible, so as to enable the plants to become established before growth ceases. A piece of land that has been thoroughly manured and cleaned with a crop of early vegetables is very suitable for the purpose. In the North, where the one-season cropping system is practised, the plants are set out 9 in. to 12 in. apart with 24 in. to 27 in between the rows. But for three to four years' cropping the spacing is usually wider, such as 12 in to 18 in. between the plants and 30 in to 36 in. between the rows. Plant firmly in land that is well consolidated

Land to be planted out into bush fruits is now probably carrying a vegetable crop. Such land should receive special attention with a view to cleaning it well, including the headlands. It will then be clean and in good heart for planting in the month of May.

Market-garden Work.

Many good crops of potatoes and onions are spoiled in the operations of harvesting. This is done chiefly by leaving them in the ground for some time after they are mature, harvesting them in dull or showery weather, and storing them without grading out diseased and broken specimens. Most important is it that these valuable crops should be harvested in fine weather at the first opportunity after they reach maturity If they are of a type and quality suitable for long storage all damaged and defective tubers or bulbs should be graded out, and the sound stock should be given good storage. For the storage of onions dry airy conditions are necessary, while for potatoes a clean, dark, cool, humid storeroom is best. For a while considerable moisture is given off when the produce is stored, and ample ventilation is necessary to dispose of it.

Important sowings in the coming month are cabbage for spring cutting and shorthorn carrots for lifting in the spring when the main crop is about used up ; also spinach and turnips.

Close attention must be given to spraying the celery crop as required, for fungus and insect pests are often found attacking these plants.

The Home Garden.

In the South Island the present time is most suitable for sowing down new lawns. Supposing the land to be clean and well cultivated, it should now be rolled when the soil is comparatively dry, and the surface raked smooth. This should be repeated until the surface is even in every respect ; the seeds should then be sown and raked in.

—*W. C. Hyde, Horticulturist, Wellington.*

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR DECEMBER, 1929.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old		Yrs dys.	lb		lb	lb.
Dominion Colrina	Ruakura Farm of Instruction, Hamilton	2 15	242·0	365	10,376·3	579·01
Woodlands Felicie	P. J. Petersen, Waitara	2 10	241·5	365	8,265·6	550·54
Ferncrest Aster	W. J. Paul, Toatoa	1 340	240·5	365	8,010·7	517·38
Pari Climber	F C. Butt, Opotiki	2 10	241·5	365	9,934·1	512·82
Velebit Flower*	G. E. Yelchich, Waiuku	2 21	242·	303	7,800·1	509·27
Oaklands Charming	F. W. Cornwall, Bell Block	2 20	242·5	365	6,572·5	460·88
Lisbury Miss Superior	M. A. Jennings, Mauriceville	2 26	243·1	365	8,770·2	433·51
Jersey Meadows Sunflower	H H Phillips, Te Rehunga	1 328	240·5	365	7,078·6	423·29
Pinewoods Golden Heather	G H Bell, Oakura	1 311	240·5	345	7,079·0	410·10
Squire's Iris	H H Phillips, Te Rehunga	2 0	240·5	365	7,513·3	402·32
Leno's Fawn Beauty	T. and A. Smith, Otorohanga	2 17	242·2	365	6,419·0	397·14
Pari Dawn	F. C. Butt, Opotiki	2 12	241·7	365	7,011·3	392·02
Holly Oak Sungleam	F. Parsons, Patea	2 0	240·5	365	6,608·0	386·08
Glencoe Diamond	J. M. Clarke, Maunu	2 32	243·7	344	6,250·2	383·21
Volunteer's Ruby	G H. Bell, Oakura	1 289	240·5	364	6,798·0	380·85
Stirling Dusk	J A. Moffat, Turiwiri	2 32	243·7	365	6,096·5	378·83
Pinewoods Golden Tresses	G H. Bell, Oakura	1 320	240·5	365	5,462·7	368·62
Stirling Lady	J A. Moffat, Turiwiri	2 43	244·8	365	6,312·1	367·01
Pari Patch	F. C. Butt, Opotiki	2 15	242·0	365	7,205·6	363·89
Roslyn Eva	A. J. Harris, Bombay	2 3	240·8	348	6,799·3	322·69
Mangaraupi Lassie	E A. Harrington, Hukanui	2 84	248·9	307	6,069·4	310·91
Glad News	T. E. Churches, Awakino Pt.	1 312	240·5	365	5,345·9	309·98
Wyndale Georgina	J. M. Clarke, Maunu	2 24	242·9	282	5,874·6	308·41
Corra Lynn Sunshine	A. Best, Bombay	2 2	240·7	365	5,723·0	297·78
Roslyn Exile	A. J. Harris, Bombay	2 27	243·2	322	5,204·1	296·55
Glenview Delightment	L. R. Fuller, Greenmeadows	1 312	240·5	365	5,230·0	278·08
Senior Two-year-old.						
Igatpuri Morlena	C. G Stuart, Rockville	2 311	271·6	365	8,787·3	566·79
Dominion Decoration	Ruakura Farm, Hamilton	2 278	268·3	365	9,235·6	507·95
Dominion Gaysome Beauty	Ruakura Farm, Hamilton	2 356	276·1	257	6,309·4	368·34
Three-year-old.						
Princess Mermaid*	G. E. Yelchich, Waiuku	3 361	313·1	365	15,481·5	829·63
Dominion Edna	Ruakura Farm, Hamilton	3 5	277·5	365	9,588·4	576·51
Holly Oak Rosette	Dr. C. G. Aickin, Auckland	3 360	313·0	329	9,295·4	497·70
Glenwillow Lassie	W. Raymond Campbell, Matakana	3 349	311·9	365	9,937·0	497·37
Dominion Miro	Ruakura Farm, Hamilton	3 279	304·9	357	8,149·9	493·94
Dominion Rosary	Ruakura Farm, Hamilton	3 23	279·3	322	8,900·8	454·36
Mount Kowhai Eileen	R. J. Johnston, Runciman	3 89	285·9	365	7,673·6	406·32
Tyntesfield Zeala	R. K. Garland, Okauia	3 5	277·5	331	6,544·2	370·93
Sunshine Beauty	E. A. Harrington, Hukanui	3 49	281·9	309	7,435·7	326·75

LIST OF RECORDS—*continued.*

Name of Cow and Class	Tested by	Age at Start of Test	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued*					
Four-year-old		Yrs. dys	lb.		lb	lb.
Eaton Birdie ..	A O Brown, Kamo ..	4 32	316·7	365	12,002·4	734·67
Orange Dale Madeline	Estate of W. J. Hall and Son, Matatoki	4 4	313·9	365	10,360·2	631·05
Ivondale Duchess Karaka	G. R. and H. Hutchinson, Auckland	4 56	319·1	365	11,928·1	572·97
Dominion Golden Fancy	Ruakura Farm, Hamilton	4 350	348·5	346	11,865·8	555·55
Brooklyn Lavinia .	H. J. Lancaster, Glen Oroua	4 36	317·1	311	9,572·2	499·46
Bonwin of Lyndale ..	Mrs E E. Norton, Waimauku	4 54	318·9	365	8,591·0	445·96
Majesty Swan's Girlie	Mrs. V A. McIlveen, Taupaki	4 22	315·7	295	7,785·8	420·01
Ebors Agnes ..	R J Wilson, Putaruru ..	4 342	347·7	305	8,495·1	372·94
Mature.						
Beechlands Preference	A. Moreland and Sons, Te Rapa	7 50	350·0	365	15,540·3	847·49
Pride's Golden Hope	R E. Clements, Awakino Point	6 287	350·0	365	10,997·4	647·60
Glen Willow Girlie ..	W Raymond Campbell, Matakana	5 78	350·0	357	11,529·4	633·12
Dominion Coral ..	Ruakura Farm, Hamilton	5 338	350·0	365	11,583·9	611·63
Lakeside Tilly ..	W J. Paul, Toatoa ..	7 320	350·0	365	10,939·8	577·50
Jersey Brae Princess Mary	T. Brownlee, Pukekohe ..	7 67	350·0	365	9,912·3	554·87
Royton Dark Beauty	A. R Clark, Hamilton ..	7 157	350·0	348	10,689·0	553·04
Memoir	W Raymond Campbell, Matakana	7 340	350·0	365	11,446·0	538·79
Tauwhare Daisy ..	Dr C G Aickin, Auckland	5 41	350·0	357	8,775·4	531·04
Wairua Carlysle ..	A. L. Dermer, Feilding ..	7 14	350·0	365	9,906·7	530·82
Orange Dale Guava ..	Estate of W. J. Hall and Son, Matatoki	5 344	350·0	338	9,025·9	521·76
Fransiska	A. L. Dermer, Feilding ..	10 6	350·0	365	8,421·9	511·67
Pilot's Gem ..	T Brownlee, Pukekohe ..	9 46	350·0	365	8,314·5	507·62
Awa Silver Princess	J. A Blake, Waipawa ..	5 81	350·0	339	8,915·7	492·85
Vernon Cherry Bloom	G. R. and H Hutchinson, Auckland	6 24	350·0	288	9,356·5	488·57
Beechlands Violette	A. Moreland and Sons, Te Rapa	10 265	350·0	341	9,872·0	425·09
St Aubin's Aster ..	J. G Harvey, Taupiri ..	12 195	350·0	309	7,284·1	414·23
Omagh Beauty ..	R K. Garland, Okauia ..	6 37	350·0	336	8,557·6	408·79
Silverleys Nita ..	F. Parsons, Patea .	5 20	350·0	334	7,576·7	404·06
Vicella	T. Foreman, Alton ..	8 45	350·0	323	7,654·4	375·83
Carmen Sylva ..	W. J. Paul, Toatoa ..	5 17	350·0	298	7,322·8	359·47
	FRIESIANS.					
Junior Two-year-old.						
Hobson W.S.P. Zozo†	W. H. Madill, Auckland ..	2 165	257·0	365	15,500·1	531·31
Glenmore Pietje Pride*	H. Johnson and Son, Stratford	2 2	240·7	365	14,570·7	522·46
Pareora Burke Park*	A. S. Elworthy, Timaru ..	2 9	241·4	365	16,146·6	518·74
Hobson Princess Pontiac II†	W. H. Madill, Auckland ..	2 172	257·7	365	16,299·0	514·14
Hobson Acme Mercedes†	W. H. Madill, Auckland ..	2 155	256·0	365	14,416·5	505·37
Oakview Primrose Hengerveld†	Oakview Stud Farm, Auckland	2 20	242·5	352	13,771·0	420·74
Wescoll Diamond* ..	Wesley Training College, Paerata	2 120	252·5	365	8,510·4	202·70

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert	Yield for Season.		
				Days.	Milk	Fat.
FRIESIANS—*continued*						
Junior Three-year-old		Yrs. dys	lb		lb.	lb.
Patchwork Domino of Oakview†	Oakview Stud Farm, Paerata	360	283·0	365	17,061·7	531·78
Senior Three-year-old						
Totara Pontiac Countess†	Piri Land Co , Auckland ..	3 246	301·6	365	16,414·6	610·57
Sunbank Woodcrest Colantha	J. Urquhart, Invercargill ..	3 324	309·4	296	13,127·3	477·61
Sunbank Woodcrest Ruby	J. Urquhart, Invercargill ..	3 320	309·0	319	16,520·0	472·56
Senior Four-year-old.						
Merrylea Inka May Griselda*	F. J. McDonald, Waitati ..	4 292	342·7	365	18,398·1	684·35
Mature.						
Dutchland Makanui of Oakview†	Oakview Stud Farm, Auckland	8 47	350·0	365	21,556·2	754·72
Glenmore Tilly Alcartra*	H. Johnson and Son, Stratford	7 262	350·0	365	18,192·7	639·18
Cluny Pietje Brundee*	Piri Land Co., Auckland ..	5 195	350·0	365	17,630·9	605·78
Murihiku Woodcrest Pearl	J. Urquhart, Invercargill ..	5 361	350·0	291	13,495·3	396·84
MILKING SHORTHORNS.						
Senior Two-year-old.						
Dominion Athlea of Ruakura	Ruakura Farm, Hamilton	2 360	276·5	349	11,674·8	537·93
Haurua Queen† ..	A. L. Souter and Son, Waerenga	2 332	273·7	313	8,481·2	379·79
Senior Four-year-old.						
Dominion Arabis of Ruakura	Ruakura Farm, Hamilton	4 305	344·0	348	8,285·4	353·95
Mature.						
Dominion Alsatian of Ruakura	Ruakura Farm, Hamilton	5 338	350·0	343	11,894·5	534·31
Dominion Lola of Ruakura	Ruakura Farm, Hamilton	5 331	350·0	365	13,218·5	514·58
Dominion Jacaranda of Ruakura	Ruakura Farm, Hamilton	6 11	350·0	300	11,610·5	513·48
Cairnbank Young Lady	W. J. Cooper, Rapanui ..	5 5	350·0	321	9,676·8	399·07
AYRSHIRES.						
Mature.						
Glengyle Mountain Maid	Mrs. J. H. Winter, Invercargill	5 37	350·0	365	12,204·9	439·74
GUERNSEYS.						
Three-year-old.						
Dominion Flora's Pride	Rukura Farm, Hamilton	3 361	313·1	365	10,339·4	593·29

LIST OF RECORDS—*continued*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

Second-class Certificates.

Jerseys.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Days.	Milk.	Fat.
		Yrs. dys.	lb		lb.	lb.
Junior Two-year-old.						
Orange Dale Raindrop	Estate of W J. Hall and Son, Matatoki	1 318	240·5	365	8,242·4	442·33
Brookley Sunshine ..	E. W. Jacobs. Horotiu ..	1 349	240·5	338	7,599·5	424·05
Three-year-old.						
Runnymead Baby ..	T. and A. Smith, Otorohanga	3 361	313·1	365	10,463·4	558·93
Mature.						
Beechlands Queen ..	A. Moreland and Sons, Te Rapa	7 338	350·0	365	10,918·9	624·72
Eureka Majestic ..	W. T. Luxton, Hamilton ..	8 297	350·0	365	8,382·7	466·09

Friesians.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Days.	Milk.	Fat.
Mature.						
Mahoe Adiantum ..	R. A. Wilson, Bulls ..	6 0	350·0	365	19,230·1	664·8

Ayrshires.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Days.	Milk.	Fat.
Two-year-old.						
Dominion Carol ..	Ruakura Farm, Hamilton	2 336	274·1	365	11,591·5	529·35

—*Dairy Division.*

CERTIFICATION OF RYE-GRASS SEED.

LIST OF GROWERS AND REGISTERED AREAS, SEASON 1929–30.

PRINTED below is a list of growers who are harvesting seed from areas which are now registered as fit for the production of perennial rye-grass seed of the "Certified Permanent Pasture" class. A full account of the organization of the certification of rye-grass was published in this *Journal* for November, 1929. Reprints of this article are available on application to the Fields Superintendents in the several centres.

The following points are of particular importance in connection with the publication of this list :—

(1) The pastures enumerated below are in the meantime registered as fit for the production of "Permanent Pasture" seed—that is, the rye-grass is of the correct type and the stands are five years old or over, but no sample trial report is available which would render them fit for the production of "Mother" seed.

(2) As soon as possible after harvest a sample from each line will be placed under trial at the Plant Research Station, Palmerston North, and reported upon within three or four months—that is, before seed is usually sown in the South Island.

(3) If the report indicates that the seed is equal to the standard of Mother seed, the parties concerned will be notified. The seed will be recorded as Mother seed, and the first harvest progeny of that seed will be eligible for certification subject to a field inspection.

(4) Should the seed on trial prove not to be up to the standard of Mother seed it will have to be considered still as Permanent Pasture seed.

Every endeavour has been made to avoid such a possibility, and the standard has been kept very high However, a small percentage is likely to be ineligible as Mother seed, and allowance must be made in this connection.

(5) The main difference between the grower who sows down Mother seed as compared with one who sows down Permanent Pasture seed is that the first harvest progeny of Mother seed is eligible for certification (subject to a field inspection), whereas the first harvest progeny of Permanent Pasture seed is not eligible under any condition whatsoever.

(6) Since white-clover seed from five-year-old stands is eligible for certification as "New Zealand White Clover, Certified Old Pasture," it follows that any white clover dressed out of the rye-grass seed harvested on these areas will be eligible for certification.

Growers of Certified Permanent Pasture Rye-grass.

Name.	Address	Total Area
	Hawke's Bay District.	Acres
Allen, A W.	Tomoana	42
Allen, J. L.	Twyford	29
Anderson, F W	Twyford	4
Apperley, J.	Norton Road, Hastings	9
Bridgman, S. G	Haumoana	16
Burge, A J	Twyford	7
Burge, H. W	Twyford	5
Burns, H H.	Twyford	73
Burns, W F. M	Richmond Road, Hastings	12
Burgess, T.	Meeanee	29
Clarke, H A. R	Waiohika	25
Crawford, H.	Havelock North	10
Couper, E. D.	Te Mata, Havelock North	40
Currie, T.	Twyford	13
Elliott, D. S.	Haumoana	34
Estate (A McLean)	Twyford	41
Estate (M. Wellwood)	Raureka	26
Fernie, D	Chesterhope, Pakowhai	90
Frogley, R.	Mangateretere	25
Frost, G	Twyford	11
Gregory, R.	Clive	12
Griffiths, R	Twyford	23
Gimblett, W. J	Ngatarawa	7
Haldane, C	Raureka	48
Hickson, A.	Hills Road, Fernhill	14
Harris, J H.	Haumoana	30
Harris, J. H.	Hastings	9
Heeney, Mrs.	Mahora North	32
Hall, J	Pakowhai Road, Hastings	2
Hope, J.	Omahu Road, Hastings	11
Lascelles, P W.	Mangateretere	50
Lister, H. H.	Clive	14
Loughnan, C	Otane	7
Macdonald Bros.	Havelock North	10
Milne, C. W.	Mangateretere	8
Miller, Max	Pakowhai	7
Merrit, Mrs	Pakowhai Road, Hastings	15
McLeod, H.	Raupare	50
Macdonald, James	Meeanee	144
McLeod, W.	Paki Paki	8
MacNamara, D.	Pakowhai Road, Hastings	2
Masters, A. J.	Twyford	49
McNab, J. A., jun.	Twyford	5
McNab, J., sen.	Twyford	12

Growers of Certified Permanent Pasture Rye-grass—continued.

Name	Address	Total Area
	Hawke's Bay District—continued.	Acres
Parsons, P.	Meeanee	49
Percival, T. S .. .	Mahora North	44
Person, Mrs	Hills Road, Fernhill ..	6
Pickering and Hackett .	Waiohika	10
Robertson, J.	Haumoana . ..	38
Ramsay Bros . .	Haumoana . ..	14
Rosser, C. . ..	Paki Paki .. .	83
Rule, H. .. .	Raupare ..	17
Stewart, H N. . ..	Haumoana . ..	71
Stead, W G. .. .	Flaxmere, Raupare ..	62
Simson, E. M.	Tomoana	40
Smith, A H .. .	Poukawa . .	17
Speers, A. .	Longlands . ..	12
Speers, G. J .. .	Paki Paki . ..	10
Struthers, A	Longlands	25
Struthers, J .. .	Pukahu . ..	35
Symes, A. F M. .	Longlands .	67
Taha Otene .. .	Tomoana . ..	23
Tattersall, C E . ..	Pakowhai . ..	69
Tait, T .	Twyford	10
Tod, R. H . ..	Otane .. .	25
Thompson, H .. .	Paki Paki .. .	16
Thompson, J. B .. .	Mahora North	31
van Asch, W. . .	Craggy Range, Tuki Tuki	103
Wall, H A	Havelock North ..	18
Wall, W. J.	Karamu and Paki Paki ..	27
Wellwood, J. . ..	Raureka	19
Wellwood, R. A . .	York Road, Mahora South	28
Westcott, F. .. .	Waiohika	7
Wright and Wallace .	Hastings	8
	Total acreage ..	2,094
	Poverty Bay District	
Baird, W.	Waerenga-a-hika ..	106
Bolton, V. S.	Waerenga-a-hika ..	30
Cray's Estate	Hexton	14
Hamon, Mrs. H.	Waerenga-a-hika ..	28
Habgood, F	Patutahi	25
Jones, F. R	Ormond	9
Mullan, B. P. . ..	Waerenga-a-hika ..	10
Reynolds, G. M.	Ormond	51
	Total acreage ..	273
	Sandon District.	
Collier, F S.	Sanson	16
Grand total acreage	. .. ..	2,383

—*J. W. Hadfield, Agronomist, Plant Research Station, Palmerston North.*

Noxious Weeds Order.—The Coromandel County Council has declared cut-leaved psorolea (*Psorolea pinata*) to be a noxious weed within that county.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

GRASS-ESTABLISHMENT ON FERN COUNTRY

W. G. J , Hangatiki :—

Will you please give me a mixture for grass-seed to sow on fern country in this district. Would you advise cropping first, or would results be just as good by just ploughing and putting grass straight in ?

The Fields Division :—

Fern land is best broken in by first sowing the land in a temporary pasture of 20 lb of Italian rye-grass and 5 lb. red clover The fern should be burnt in the summer, the land ploughed, and the temporary pasture sown in March or early April. Bracken-fern, after remaining practically dormant over the winter, will invade the pasture again in the following spring. The fern comes through the ground in a soft curl, and if this is broken off no further growth will take place from the growing-point giving rise to the frond The soft curled fronds will appear in October–November, and the pasture should then be heavily stocked with cattle for short intervals, so that the heavy treading of the cattle will break off the soft fronds. Temporary pastures are generally more satisfactory than permanent ones for breaking in fern, as they throw more feed during the first year and can consequently be more heavily stocked Fern cannot be properly controlled if roots are taken as the first crop, as the fern re-establishes during the summer before the roots are ready to feed off

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DESTRUCTION OF MINT.

J. M., Bay View :—

I should be glad of advice regarding the destruction of mint, of which I have about an acre. I ploughed it up with great difficulty—the roots being like a mat, all intertwined—in June, let it lie all winter, cultivated it as well as I could in the spring, and sowed beans and maize. The mint is as thick as ever I also drained part of the land

The Horticulture Division :—

To destroy the mint at the present season it should be ploughed moderately deep and cut up well with disk harrows, following up this treatment with repeated cultivation and harrowing during fine weather. As soon as autumn rains set in the land should be sown down thickly in a cover-crop, such as blue lupins or oats and tares If there is much growth of mint on the area at the present time it should be cut and carted off to rot before the ploughing is done

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TREATMENT FOR LICE ON HORSE.

" JOCK," Methven :—

Would you please inform me as to the best method of getting rid of lice on an old horse.

The Live-stock Division :—

The following treatment has been found very useful for lice on horses: Take 1 lb. of yellow soap, ½ pint kerosene, and 1 gallon water ; cut up the soap into small pieces and boil until dissolved in the water ; when cool enough for application to the horse, add the kerosene and keep the mixture well stirred during application. The mixture should be well scrubbed into the horse, and the procedure repeated in four or five days. The animal should be clipped all over, and then singed before the treatment is carried out.

WEATHER RECORDS: DECEMBER AND CALENDAR YEAR, 1929.

Dominion Meteorological Office.

GENERAL NOTES FOR DECEMBER.

DECEMBER was a wet and stormy month. Although eastern districts experienced some hot and sultry days, there was less than the average amount of sunshine, and temperatures were considerably below normal The only considerable areas where rainfall was below the December average were in the northern half of the Auckland Peninsula, and in eastern portions of the North Island from Hawke's Bay to East Cape. Over all western districts and in the high country of the interior, precipitation was heavily in excess of the normal Most of the stormy weather was associated with the passage of cyclone centres across the South Island. Gales from between north and west were experienced to the north of the centres, while to the south of them easterly or south-easterly winds prevailed. It was these latter which accounted, to a large extent, for the high rainfalls in Canterbury and Otago. Thunderstorms were rather frequent, and in many cases severe. A large proportion were accompanied by showers of hail A considerable amount of fog was reported from both northern and southern extremities of the Dominion.

As indicated above, the unusual frequency of cyclonic depressions which has characterized the past two years was fully maintained in December. Their movement was very rapid, and this was on the whole fortunate, since although there were numbers of cases of rivers reaching flood stage they usually receded just when serious floods appeared to be imminent, and the actual damage was slight.

The first of the cyclones referred to crossed the south-western extremity of the Dominion on the evening of the 4th to 5th, and caused boisterous weather. Rain was widespread, with many heavy falls, especially from Taranaki and Wellington southwards. On the 5th there were many thunderstorms.

From the 6th to the 9th weather of the westerly type prevailed. Squally winds blew from some westerly quarter, frequently reaching gale force, and western districts especially experienced showery weather.

The finest spell of weather during the month followed the westerly weather and persisted till the 15th. During this period a severe tropical cyclone developed in the Fiji Group and moved slowly away. On the night of the 11th and the morning of the 12th a heavy fog in Cook Strait caused delays to shipping.

On the 17th the second cyclone crossed southern Otago, and again northerly gales and almost general rain accompanied its passage. Thunderstorms were a marked feature of this cyclone during the whole time it was moving over the Tasman Sea and New Zealand.

A third cyclone traversed the Dominion on the 22nd, the centre this time crossing South Canterbury. Precipitation was again general, and the southerly winds in the rear of the depression brought particularly heavy rain to the eastern districts of the South Island. At Kaikoura the phenomenal fall of 3 in. in sixty-five minutes was registered. Thunder and hail storms were very violent and widespread in connection with this storm, especially on the 22nd.

The last of the month's cyclones moved over southern Otago on the 29th. Boisterous weather and almost general rain accompanied its passage. At Wellington over seventy miles per hour was registered in a northerly gale on the 29th.

Each of the cyclonic storms described was responsible for falls of snow on the ranges in the South Island, and a number of frosts occurred.

RAINFALL FOR DECEMBER AND CALENDAR YEAR, 1929, AT REPRESENTATIVE STATIONS.

No.	Station.	December, 1929				Calendar Year.	
		Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall, 1929	Average Rainfall
	North Island.						
		Inches.		Inches.	Inches	Inches.	Inches.
1	Kaitaia	0·97	7	0·20	3·28	54·66	50·4
2	Russell	1·53	7	1·07	2·65	45·32	53·5
3	Whangarei .	1·67	11	0·74	3·11	62·98	61·8
4	Auckland ..	3·93	20	1·18	2·84	51·52	45·0
5	Hamilton ..	4·57	18	1·49	3·72	48·98	52·3
5A	Rotorua .. .	5·60	13	1·75	3·83	60·31	55·0
6	Kawhia	6·10	20	1·60	3·25	55·69	56·6
7	New Plymouth ..	6·87	21	1·48	4·33	60·13	60·0
8	Riversdale, Inglewood	12·35	23	2·57	7·43	88·30	103·8
9	Whangamomona ..	10·05	21	1·36	5·84	81·18	80·6
10	Eltham	6·74	16	1·15	3·83	58·91	52·9
11	Tairua .. .	1·80	10	0·44	4·68	51·07	67·0
12	Tauranga .	3·90	18	0·95	3·47	46·71	53·0
13	Maraehako Station	2·66	12	0·50	2·74	55·13	52·8
14	Gisborne ..	1·67	9	0·57	2·16	43·58	46·0
15	Taupo .. .	3·22	15	1·06	3·36	42·83	46·8
16	Napier	1·09	9	0·29	2·30	28·58	35·0
17	Maraekakaho Station	1·56	15	0·26	2·21	33·09	35·3
18	Taihape	4·40	20	0·97	3·42	34·98	38·0
19	Masterton ..	3·71	16	0·89	2·80	32·60	39·0
20	Patea	5·09	16	0·90	3·67	*	44·3
21	Wanganui ..	4·54	11	0·80	2·63	32·95	36·9
22	Foxton	4·40	14	1·20	2·54	32·58	31·5
23	Wellington (Karori)	3·06	16	0·67	2·99	53·92	45·4
	South Island.						
24	Westport ..	12·83	29	2·24	6·60	75·13	79·5
25	Greymouth ..	13·58	23	1·90	8·56	94·91	102·0
26	Hokitika ..	19·75	25	3·23	10·70	109·80	115·0
27	Ross .. .	21·84	24	3·18	12·04	136·65	136·9
28	Arthur's Pass .	29·11	17	8·70	14·93	176·71	156·6
29	Okuru	15·71	17	1·86	11·73	119·12	149·7
30	Collingwood .	10·81	19	2·47	8·01	*	97·9
31	Nelson . ..	3·99	17	1·04	2·69	48·61	39·0
32	Spring Creek ..	2·89	17	0·55	2·04	37·99	30·6
33	Tophouse ..	11 21	23	1·64	5·66	79·38	61·9
34	Hanmer Springs ..	4·54	18	0·93	3·28	41·94	41·0
35	Highfield, Waiau ..	3·20	8	1·26	2·58	33·90	33·5
36	Gore Bay ..	1·96	11	0·96	2·77	29·02	31·2
37	Christchurch ..	3·40	19	1·98	2·06	23·56	25·0
38	Timaru	2·44	21	0·46	2·41	23·36	24·0
39	Lambrook Station ..	5·10	17	0·72	2·58	32·24	25·8
40	Benmore Station ..	6·24	18	1·16	2·13	31·45	27·0
41	Oamaru	3·17	19	0·95	2·15	27·64	22·0
42	Queenstown ..	4·21	17	0·52	2·59	32·00	31·0
43	Clyde	2·50	12	0·44	1·79	15·38	14·9
44	Dunedin	5·94	23	0·42	3·48	41·96	37·0
45	Wendon	3·42	19	0·58	2·76	28·90	30·2
46	Gore . ..	4·10	25	0·60	3·33	32·85	35·0
47	Invercargill ..	5·25	23	0·75	4·26	41·48	45·0
48	Puysegur Point ..	8·43	24	1·79	6·63	83·15	85·6
49	Half-moon Bay ..	5·77	22	0·75	5·69	56·21	58·7

* Incomplete.

—*Edward Kidson, Director of Meteorological Services, Wellington, 7/1/30.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 14th November to 31st December, 1929, include the following of agricultural interest :—

No. 61062 Manure distributor, J. Munro, Lochiel. No. 62461 Casein-drying: J Pasquier, A Meese, and R L. Billiez, Joue-les-Tours, France. No 62913 Hay-handling apparatus, J. P McLeod, Ashburton No. 63071 : Milking-machine; Aktiebolaget Separator, Stockholm, Sweden (also Nos 63842 and 63843) No 63557 Milk treatment, J O and N. V Hickman, Rickmansworth, England No 63609: Beef-chilling rack; Swift and Co, Chicago, U S.A. No. 63699 Wool-scouring; L. A. and A E Bowler, Geelong, Victoria No. 63226 Fertilizer: W. C. Gentles, New Plymouth No 63684 : Hay-press; R. S Whicher, Elaine, Victoria No 63767 Milking-machine, Stuart Turner, Ltd., Henley-on-Thames, England. No 63792 : Grass-cutting, W. C. D Dampier-Whetham and T B Wood, Cambridge, England No. 61945 Animal trap, F. G. Carr, Sydney, N S W. No 62080 Tine harrow, E W Poole, Dannevirke No 62098. Milking-machine pulsator, R P Houghton, Hamilton. No 63411 Cheese; S H. Hartmann, Melbourne, Victoria No 63713 : Manure-distributor, J G Clark, Ohura No. 63850 Harrow, K V. Henrikson, Tatuanui. No. 63856 Hay-stacker, Newton King, Ltd, New Plymouth No 61899 : Milk-protector; W. F. Hussey, Ohakune No 61937 Teat-cup support; C. F Leonards, Waharoa. No 62067 Teat-cup, A. B. Robertson, Hamilton. No 62256. Separator for milk, A E Denham (nominee), Wellington No 63279 Milking-machine, J Taylor and Co. Ltd, Eltham No. 63891. Seed-treatment, Warren-Teed Seed Co, Chicago, U S A No 63982 : Triple Superphosphate, F. C. P. and F Palazzo, Florence, Italy No. 63984 : Dicalcium phosphate and nitrate, F C. P. and F Palazzo, Florence, Italy.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. prepaid

FORTHCOMING AGRICULTURAL SHOWS.

THE following show-dates have been notified by agricultural and pastoral associations :—

Helensville A. and P. Association: Helensville, 29th January.
Opotiki A. and P. Association. Opotiki, 1st February
Feilding A. and P Association. Feilding, 4th and 5th February.
Whakatane A. and P. Association : Whakatane, 5th February.
King Country A. and P. Association. Te Kuiti, 6th February.
Rodney Agricultural Society: Warkworth, 8th February.
Te Puke A. and P. Association. Te Puke, 8th February.
Dannevirke A. and P. Association: Dannevirke, 11th and 12th February.
Tauranga A. and P. Association, Tauranga, 11th and 12th February.
Franklin A. and P Association Pukekohe. 14th and 15th February.
Buller A. and P. Association. Westport, 14th and 15th February.
Masterton A. and P Association: Solway, 18th and 19th February
Katikati A. and P. Society: Katikati, 19th February.
Marton A. and P Association. Marton, 20th February.
Auckland A. and P Association : Auckland, 27th February to 1st March.
Taranaki Agricultural Society. New Plymouth, 5th and 6th March.
Waikato Central Agricultural Association Cambridge, 5th and 6th March.
Morrinsville A. and P. Society: Morrinsville, 12th March.
Hawke's Bay A. and P Society Autumn Show, Tomoana, 19th March.
Methven A. and P. Association: Methven, 29th March.
Oxford A. and P. Association Oxford, 3rd April.

Tokaanu Soils Map.—In the article on the Soils of Tokaanu published in the December issue of the *Journal* the scale of miles was inadvertently omitted from the map. The scale is slightly less than 1 mile to the inch: 1 inch = 0·903 mile.

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DISEASES OF DAIRY COWS.

(Continued.)

J. HILL MOTION, B.Sc. (Agric.), B.Sc. (Vet.Sc.), M.R.C.V.S., D.V.S.M., Animal Bacteriologist, Wallaceville Veterinary Laboratory.

IV. TEMPORARY STERILITY.

THE condition or disorder known as "temporary sterility" or "returning to the bull" presents a most perplexing problem of the greatest economic importance in New Zealand and elsewhere in the world where dairy-farming is practised. As the name suggests, conception occurs sooner or later, and the cow carries her calf to the end of the normal gestation. The cow comes in season regularly, and only after repeated services at recurring "heat" periods does she become pregnant. There are presumably no definite clinical symptoms, no pathological changes—in fact, nothing to indicate the seat of the trouble or the reason for this breeding anomaly.

It is particularly in New Zealand that temporary sterility has led to such heavy losses. The reason for this is not far to seek when one recognizes the need for seasonal calvings in order to catch the early spring growth, and at the same time to utilize to full advantage the succulent early summer pastures before the onset of the dry spell which so frequently sets in by midsummer. With delayed conception, pregnancy occurs too late in the season, with the result that the cow comes into profit at the wrong time of the year—winter dairying not being the practice in this country.

It must be appreciated that temporary sterility occurs in most dairying countries, but whether or not the inciting causes or predisposing factors are the same it is difficult to say. The importance to be attached to this type of sterility is governed by the methods of dairying in vogue, whether one-season calvings or spring and autumn calvings are necessary for the purposes of the trade, or whether calvings can be permitted at any season of the year. Seasonal calvings are the rule in New Zealand, and accordingly a temporary failure to conceive presents a problem of ever-increasing importance, far greater even than the losses occasioned by genital defects and inflammations which permanently prevent conception.

Again, in countries where the cows are housed for almost six months of the year, and artificial feeding has to be resorted to, many other factors are at work which favour the incidence of breeding anomalies of a sterilizing nature. These, however, invariably lead to "permanent" sterility. If, perchance, a "temporary" sterility is occasioned by a deficiency in the pasture, soil, or drinking-water, then it can easily be appreciated that such temporary sterility is likely to be more common in countries where the cows are given no concentrates whatever than in those where artificial feeding must be resorted to when the cows are housed during the winter, and where a reduced ration of concentrates is fed even during the summer months when the cows are at pasture. This is assuming, of course, that a rational system of feeding is being adopted under such conditions.

Another aspect of the problem presents itself, and that concerns the bull in those areas where seasonal calvings are desirable. The object aimed at is a breeding efficiency of close on 100 per cent., and that spread over at the most two months of the year. It is hoped under such circumstances to get all cows in calf at the first or at most the second service, whether the bull is running with the cows or service by hand is practised. It is feasible, therefore, to assume that under this method of breeding it is impossible to get anything like 100 per cent breeding efficiency, for it is a well-established fact that too many services by the bull during a comparatively short period will result in too many "returns," and even more so than putting too many cows to the same bull over a relatively long period.

Incidence of Temporary Sterility.

The geographical distribution of this condition in New Zealand naturally follows those districts where dairy-farming is most intensively practised, and consequently one would expect the losses to be most severe in Taranaki and the Waikato, but other districts are far from immune. The local incidence would appear to vary considerably: one farm may experience an unexpected occurrence this year, and next year, apart from the late calvings, no cases of this disorder will be reported. Temporary sterility—which may be assumed to include all cases where conception has not occurred after the second service—may account for close on 100 per cent. failures on one farm, while on the adjoining farm, where conditions of management are presumed to be the same, the condition is unknown.

All breeds kept under the dairying conditions and management met with in New Zealand are equally susceptible. The age incidence is presumed to have very little bearing on temporary sterility, but occasionally the trouble would appear to commence and prevail among the heifers.

The seasonal occurrence naturally centres round the breeding-season—from about November to March. It is remarkable to find that by the month of January probably close on 95 per cent. of the herd have become pregnant, and the remaining 5 per cent. are either disposed of, or are kept through the winter as strippers, when they usually hold to the first service. From year to year the incidence of temporary sterility would appear to be most

erratic, and in the absence of reliable data to the contrary this condition is presumed to have become decidedly worse during the past ten years. In the present state of our knowledge of its occurrence it may be assumed that outbreaks may occur on all types of pasture. Within the herd any percentage or even all of the cows may appear to be affected to a greater or less extent.

Data concerning Temporary Sterility.

Valuable work on the disorder in New Zealand has already been done, and much useful information is now being collected by the veterinary officers of the Department of Agriculture. The greatest difficulty in the investigational work in connection with this form of sterility is to be found in the fact that the majority of farmers allow the bull to run with the herd, with the result that breeding data are not available, excepting only the information that several of the cows were "empty" at the end of the season. Therefore it is only in herds where the bull is kept apart from the herd, and each cow is brought for service as occasion arises, that reliable figures are available. The herd which is maintained entirely by home-reared heifers and young bulls which have not previously been used permits of a statistical survey and analysis over a period of years.

The number of abortions and the extent of infection with *Bacillus abortus* (the causal organism of contagious bovine abortion) must also be considered in connection with temporary sterility.

More recently the question of overproduction or unduly continued production as a possible cause of temporary sterility in dairy cows has been receiving considerable attention, and it is expected that from the reliable and authentic data now available from the herd-testing organizations very useful information will be obtained which may throw considerable light on this perplexing problem.

A considerable number of soil and pasture analyses have been undertaken, but many more will have to be made available before a definite pronouncement can be made regarding the condition. This would apply also to the biochemical aspect of the problem.

Finally, and perhaps most important of all, the study of the œstrous cycle in both normal and sterile cows, under field and herd conditions, will have to be undertaken in a systematic manner, to be followed up later at the meat-works when the opportunity presents itself.

From what has just been stated it is evident that the position regarding temporary sterility is very unsatisfactory, and before anything tangible can be arrived at sufficient data must be amassed to meet the requirements outlined above.

Œstrum, Conception, and Pregnancy.

Before proceeding to outline the various causes presumed to lead to temporary sterility it will be of value to understand the natural sequence of events necessary for a successful mating to result in conception, and for the female to continue in pregnancy until the normal parturition. The ovary must be considered the altogether

dominating portion of the genital complex, since its function is closely associated with the appearance and disappearance of certain different tissue formations within its substance. Here are to be found the follicles, the corpora lutea, and interstitial tissue, whose functional activities are constantly associated with definite cyclical changes associated with œstrum, ovulation, conception, and pregnancy Pregnancy results more or less in an interruption of these cyclical changes, but after parturition or calving the œstrous cycle is again renewed.

The follicles develop rapidly just prior to the manifestation of œstrum or heat, and each follicle contains an ovum, which is liberated by the rupture of the follicle at the opportune moment for fertilization, or otherwise should service not be permitted. It will be evident, therefore, that the temporal relationship between ovulation—*i e.*, rupture of the follicle and liberation of the ovum—and the appearance of œstrum or heat is all-important Authorities differ as regards the exact moment of ovulation, but Nielsen considers that most probably ovulation occurs immediately before or during the first stage of heat, although the time of ovulation relative to œstrum may, and certainly does, vary considerably.

The scar or wound resulting from the rupture of the follicle heals over and forms the corpus luteum or "yellow body" of œstrum or pregnancy, as the case may be. The presence of the corpus luteum is definite proof that ovulation has taken place at a shorter or longer time previously, depending upon the age of the corpus luteum. The corpus luteum gradually increases in size till the eleventh day after œstrum, when it is at its maximum, and then gradually contracts, thus constituting the corpus of œstrum After conception—that is, when the liberated ovum is fertilized—the resulting corpus luteum of pregnancy persists throughout pregnancy, gradually increasing in size during the earlier months and regressing after the middle of pregnancy.

The interstitial tissue of the ovary results from the degeneration of the immature follicles, since many are formed just preceding heat, but only one is ruptured at each œstrum with the liberation of one ovum. This degeneration of the follicles is governed by the actively secreting corpus luteum.

The function of the various tissue formations is bound up in the mechanism culminating in œstrum, conception, and pregnancy, and accordingly a clear understanding of these functions is essential in the study of temporary sterility.

The lutein body, acting as a ductless gland, or endocrine organ, is now presumed to function as follows: (1) To govern the formation of the interstitial tissue; (2) to prevent further ovulation, by inhibiting the growth of the follicles; (3) to determine the development of the placenta or after-birth and the growth of the uterus or womb; (4) to secure the connection between the maternal and fœtal placentæ, and to nourish the fertilized ovum or fœtus.

The functions of the interstitial tissue may be summarized as: (1) To govern the normal indications of œstrum, (2) to favour the development of the mammary gland, the secondary sexual characters, and the genital tract; (3) to influence the general metabolism and temperament.

Finally, the functions of the follicles may be concerned with the following: (1) The normal occurrence of œstrum; (2) the maturation and liberation of the ovum, which implies the act of ovulation

The normal occurrence of œstrum is regulated by the activities of presumably both the interstitial tissue and the follicles, which are in turn governed by the corpus luteum, the former producing a secretion inducing œstrum, and the latter a secretion inhibiting it, but favouring attachment and development of the embryo, at least during the earlier stages of pregnancy

To conclude, the fertilization of the ovum after service takes place either within the tubes leading from the ovary, or within the uterus or womb, where in either case it becomes implanted, obtains its nourishment, and rapidly grows to form the fœtus or calf. After conception the cervix or opening into the womb from the vagina becomes sealed, and remains so until parturition.

It can be easily understood that the physiological processes concerned with reproduction of the species presents, even under normal conditions, an ever-changing complex, so much so that under certain circumstances a temporary derangement of these processes is not to be wondered at. Exactly what takes place is exceedingly difficult to say, but, excluding infection or other pathological conditions, it can be seen that there are at least three possibilities: (1) The occurrence of œstrum and the act of ovulation are not coincident, the latter taking place too soon or even too late, thus making fertilization impossible, at least temporarily; (2) ovulation does not take place, although œstrum is apparently normal and service satisfactory; (3) the temporal relationship between the occurrence of ovulation and the manifestation of œstrum is normal, and conception occurs, but death of the embryo takes place at a very early stage, from implantation being impossible.

This interpretation of the functional derangement associated with temporary sterility would appear to explain what actually takes place in those cases where the cow comes in season at regular physiological intervals and no pathological changes can be demonstrated even at post-mortem examination. Such animals may miss several services before conception occurs, and in many cases seem to conceive after a prolonged rest.

Causes of Temporary Sterility.

The predisposing or contributory causes leading to temporary sterility in dairy stock would of necessity be many and varied, and at the present state of our knowledge many theories have been elaborated to explain this breeding anomaly. At the outset, therefore, it must be understood that in the absence of reliable data concerning the condition in New Zealand, and in view of the incomplete nature of the experimental work at present in progress, the writer wishes to submit only a short summary of the main lines of thought at present held. Many of the statements here made may still be controversial, but space does not permit of detailed criticism being given. In arriving at many of the conclusions herein recorded the writer has behind him many years of practical experience among

dairy stock in both health and disease, and also the recent views of many European workers in the field of sterility among bovines

For purposes of classification it may be assumed that the causes of temporary sterility can be summarized under three main heads: (1) Infection or pathological conditions; (2) deficiencies in the pasture or diet; (3) physiological derangement, resulting from either of the foregoing or from irrational management.

(1) INFECTION

The facts submitted from many farms would appear to justify the view that infection of some sort is wholly responsible for temporary sterility However, extensive bacteriological examination of material collected from all situations in the genital tract of both the female and the male have been carried out in all parts of the world, and no particular organism has been isolated which could reproduce the condition.

The view that *B abortus* may be responsible for many cases of temporary sterility has been tenaciously held for many years This, however, presumes the existence of an endometritis or inflammation of the womb—at least during the few weeks after the act of abortion or even normal calving when the organism can be isolated from the uterine discharges. Usually in about three weeks time the uterus has freed itself of all infection, and only on one occasion have the bacilli been demonstrated after fifty-one days. In herds where contagious abortion is in evidence the first œstrum at least should be missed, and preferably the second also, thus allowing possibly over sixty days for the migration of the organisms from the uterus, and the disappearance of the endometritis. Information to hand from our field investigations would suggest that at least in New Zealand infection with *B. abortus* can be ruled out as a possible cause of temporary sterility.

Pathological changes or inflammations, possibly bacterial, have been met with in many cases of sterility, and as occasion arises each and every one of these conditions as hypotheses have had their supporters. Accordingly a short survey is given.

Endometritis.—Inflammation of the uterus has been dealt with in the preceding article of the series as a cause of sterility. It will therefore suffice to state that, at least in New Zealand, the post-mortem findings in cows culled as suffering from temporary sterility did not reveal an endometritis Stalfors also reports that he examined the uterine contents of forty-four cows showing incomplete involution by means of washings with sterile water, and in all cases no pathogenic bacterial flora could be demonstrated. Again, Nielsen states that in cows suffering from endometritis heat manifestations after the third month are frequently very irregular, this irregularity increasing with the degree of chronic endometritis present, and in some cases there is even complete absence of heat. Such is not the case under New Zealand conditions where temporary sterility is common.

Salpingitis.—Inflammation of the tubes leading from the ovaries into the uterus is often met with in bovines, and the significance of salpingitis in sterility has been urged, by Williams in America and Oppermann in Germany, on the basis of infection within the tubes.

Hundsberger would appear to negative such an assumption since in his extensive examinations he found bacteria more often in the tubes of pregnant than of non-pregnant animals.

Sterilizing Anomalies of the Ovaries.—Here the problem is intimately linked up with the ovarian cyclical changes already described, and in addition inflammations, persistent lutein bodies, cystic degenerations, &c., but, except in a very few cases, clinical examinations per rectum and per vagina, and post-mortem examinations fail to lend support to pathological changes in the ovaries causing temporary sterility. Congenital and acquired hormonal defects causing a temporary derangement may offer a suitable explanation, which will be discussed later.

Cervicitis.—Recently in New Zealand great prominence was given cervicitis, or inflammation of the canal leading from the vagina to the uterus, as at least a cause of the condition, but experimental data now available have not established this fact.

Vaginitis.—Opinions differ regarding the bearing of both granular and vesicular vaginitis on sterility in a herd, but at the present time in Europe infectious vaginal catarrh, which for many years was regarded in Germany, Austria and Switzerland as the main cause of sterility, is considered as a fairly innocent complaint which has little to do with infertility, except in heifers, where it appears not infrequently with particularly acute symptoms, and thus service is resented and conception impossible. Yet heifers and cows suffering from vaginitis in its worst form have become pregnant.

(2) DEFICIENCIES IN THE PASTURE OR DIET.

This part of the investigation opens up a very large field with many ramifications, since it is understood that deficiencies in the natural grazing or in the diet otherwise provided will of necessity be reflected on the animal. Accordingly in order to facilitate the discussion the problem has been considered under two heads, one dealing with the soils, the pastures, and the diet, and the other with the animal itself, although more correctly they cannot be so divided. In most dairying countries analyses of the soils, the pastures, and the drinking-water have been carried out, and deficiencies of various kinds have been found, but interest seems to centre round calcium, phosphorus, and iodine, and more recently vitamin E, the anti-sterility accessory food factor.

Calcium.—Calcium of itself, when deficient in the pasture, where it may be reduced to less than one-fifth of that found in good grazings, is not seriously considered as a factor in temporary sterility. In support of this, liming experiments have not resulted in any great diminution in the incidence of the condition, other factors being considered.

Phosphorus.—Poverty of phosphorus may be even more marked than in the case of calcium, and definite evidence is now available to show that sterility may occur from a deficiency of it. "Waihi disease" in New Zealand occurs on soils deficient in phosphorus, as low as 0·20 per cent. of P_2O_5. Oestrum does not occur and the lutein bodies are retained, and thus a permanent sterility results. Similar

conditions are to be found in other parts of the world. Preliminary investigations in this country indicate a normal calcium content in connection with temporary sterility, but invariably in areas where the condition is prevalent the phosphorus content is low, though usually not sufficiently to cause a definite pathological change.

Iodine —When considering the question of disease in New Zealand one thinks of a deficiency of iodine, and in regard to temporary sterility in dairy cows the lack of iodine would certainly appear to be a factor worth investigating. The success claimed for the iodine treatment of sterility in Europe would appear to justify such a claim, and accordingly if a deficiency of iodine in either the pasture or the drinking-water does exist it is only of a seasonal nature In support of this hypothesis it is interesting to understand the effect of iodine on the genital tract, or, in other words, the animal's requirements in respect of same.

The iodine found in the thyroid glands of milch-cows shows a seasonal variation, being low in spring and high in autumn. This would probably indicate a correlation with the iodine content of the pasture, since the amount of iodine present in the thyroids is directly governed by the iodine intake. Milk, again, shows a seasonal variation in iodine content, being high in spring and low in autumn. Colostrum shows a higher iodine content, which quickly drops to milk-level in the course of a few days. The amount of iodine in the blood of the female is apparently affected by the sexual cycle, being high during œstrum and again at the end of pregnancy The iodine content of the ovary as a whole is not high relative to other tissues and organs of the body, but very small lutein bodies have a relatively high percentage of iodine, whereas the very large ones appear to have a low iodine content.

The exact bearing or influence which the thyroid has on the sex organs has yet to be determined, but it will suffice to state that thyroid feeding inhibits the development of the uterus, the implantation of the ovum, and also the nutrition of the fœtus. Since, however, the processes of implantation of the ovum and the development of the uterus depend upon the normal functioning of the lutein body, it is evident that thyroid feeding or hypertrophy of the thyroid interferes with the formation or normal functioning of the lutein body.

With these facts in view the position may be summarized as follows: There is a low iodine intake in the early spring, a low iodine content of the thyroid, a resulting hypertrophy of same, a further rapid depletion of the system in connection with parturition, owing to the increased iodine content of the blood at this stage, which is eliminated in the colostrum.

This hypothesis does not necessarily suggest a definite deficiency of iodine in the soil, but a deficiency in the pasture just prior to and coincident with the early spring growth. The question of the water-supply may have a bearing on this also, and from preliminary analyses to hand of the soil in areas where sterility is common the iodine content is relatively high, although the iodine content of the drinking-water is exceedingly low, amounting to a definite deficiency for purposes of normal metabolism in bovines.

Again, the success attending the use of dilute iodine solutions in treating cases of sterility which are definitely not due to endometritis is difficult to explain Formerly it was considered that this success resulted from a disinfection of the uterus, but it is now presumed that it is more of a stimulation. To go a step further, it is feasible that the iodine is absorbed, reaches the thyroid and ovaries, and brings about a return to normality of the physiological processes associated with reproduction.

Further work is still to be done, and as yet it is impossible to give a definite pronouncement on the supposed temporary iodine deficiency as an important factor in temporary sterility

Vitamin F.—Evans and Burr, of California, have carried out a considerable amount of experimental work in connection with this recently discovered anti-sterility vitamin, but unfortunately their published data deals only with experiments on rats.

In the presence of a deficiency of vitamin E normal conception appears to take place, and growth of the embryo proceeds till about the eighth day; death of the fœtus occurs from interrupted nutrition about the fourteenth day—that is, towards the middle of the gestation period.

It has not yet been decided how a deficiency of this vitamin affects pregnancy in bovines, but if conception actually occurs in cases of temporary sterility then death of the embryo must take place, probably within the first week following conception. The recurrence of œstrum at regular three-weekly intervals would appear to negative this.

Vitamin E is found in greater or less extent in natural pastures and in milk, and although a systemic depletion may result during lactation it is hardly feasible to suggest a complete depletion with resulting ill effects. Again, the possibility of vitamin E being present in excess during the flush of grass may have a bearing on temporary sterility, but until experimental evidence with laboratory animals is forthcoming this hypothesis may be disregarded.

(To be continued)

Classification of Pigs—The pigs in New Zealand at the 1928–29 enumeration (including boroughs) are classified as follows, the figures for the preceding year being added in parentheses: Pigs one year old and under, 466,773 (488,292); boars one year old and over, 15,267 (15,503); sows one year old and over, 74,692 (83,103) total, 556,732 (586,898), representing a decrease of 5·14 per cent. for 1928–29.

Orchard Spray Piping Systems—Reporting on recent experiences, Mr. J. H. Thorp, Orchard Instructor, Nelson, states: An instance of the blocking of pipes underground came under notice during last spring, resulting in the fruit-grower having to take up a few hundred feet of ½ in. piping, which he replaced with ¾ in. This grower uses a lot of Bordeaux powder and precipitated sulphur through his pipes, and no doubt this accounted for the trouble, as the pipes were clogged with a slimy, mucky mixture which interfered with the pressure. In several instances growers who have put in ⅜ in. pipes have had to replace with ½ in. on account of the low pressure obtainable from the ⅜ in. pipe.

GRASSLAND EVOLUTION AT TUTIRA.

TURFS OF FIFTY YEARS

H. GUTHRIE-SMITH, Tutira Station, Hawke's Bay.

TWENTY-ONE years ago a paper on the grasses of Tutira appeared in the "Transactions of the New Zealand Institute." That article having now attained its majority, it may be worth while reconsidering the tendencies therein described. Even at that time these tendencies, it need hardly be told, were towards deterioration: the conclusion reached in the paper of 1908 was that the countryside was intrinsically worth less for grazing purposes than it had been in 1879, when grasses were first sown, and, secondly, that its higher assessment was owing to a greater demand for land, and in a lesser degree because of better methods of farming and increased knowledge of stock. A further reason for reconsideration is the entrance of a new factor into the great grass question of New Zealand—the factor of top-dressing, a method probably still in its infancy.

I confine myself to Tutira because of an intimate acquaintance with it during forty-seven years, but like processes are at work on every acre of grassland throughout the Dominion. If the reader chooses, Tutira can be magnified with but slight qualifications into Hawke's Bay, and Hawke's Bay into the North Island. Though nowadays but a tenth of the old-time Tutira is in my possession, yet for the purposes of this article the larger original holding will be considered. The lands under review lie midway between Napier and Mohaka, on the Napier–Gisborne road; the hills are limestone, conglomerate, and sandstone; the soils are of every quality, from best to worst; the whole area has been thickly blanketed with waterlaid volcanic grit; in addition it has been dusted with wind-borne pumice to a depth of 3 in. or 4 in. Excepting in regard to alluvium, this rule holds—flat country, bad; steep country, good. From the latter the volcanic grit has been blown or washed or has slipped away.

Before 1879 a small portion of Tutira had taken grass—enough, at any rate, to justify the title of a "fifty-year turf"—but in 1882, when I first set foot on the station, the vast bulk of the run was still clothed in bracken, tutu, light bush, and rimu, white-pine, and totara forest. English grass was then confined to strips beneath the old limestone sea-floors, to minute sheep-camps, to pig-rootings, and Maori clearings. Seed had been carried to these spots by wild stock—wild cattle, horses, and sheep. Patches here and there had been established of alien species by alien animals.

Native grasses before 1879 subsisted in even smaller quantity. Had danthonia or *Microloena stipoides* (New Zealand rice-grass) ever thriven as weeds on the plots of fertile ground intensively worked by the Maoris they were not discoverable when the white man took possession. It sounds incredible, but as late as 1882 danthonia was a very rare grass, so infrequent that I remember noting with interest a few clumps gone to seed on a certain spot on the old pack-trail through Tangoio, and on another occasion pausing to inspect a

flourishing single plant, also in seed, on Tutira. Later a few specimens began sparsely to appear on trampled soil in the vicinity of deserted pas and kaiangas. This absence on Tutira of a grass now so widely spread must, I think, be ascribed to two causes. The first was that danthonia is not a rich-land grass; until the first flush of fertility had been consumed by rye-grass, clover, and cocksfoot it was not at home on the limestone area. The other reason was that on the great central sandstone and conglomerate trough of the run there was literally no room; bracken ran to the very edge of the cliffs, it extended to the very brim of the bogs. In another way—a very remarkable way, and a way that on unhandled country still persists—did *Microloena stipoides* hang on, so to speak, by teeth and eyelids. In these far-off days there were to be seen certain infrequent roundels of nakedness—ringworm patches, as it were—in the tall bracken of the sandstone and conglomerate area. They were doubtless the result of some fungoid disease in the rhizomes of the bracken, and on them *Microloena stipoides* survived in miserable fashion, together with the foreigners *Briza minor* and *Aira caryophyllea*.

In my paper of 1908 the outward signs of the lessened fertility of the surface soil were noted. They were the visibly thinner proportion of rye-grass and white clover, the decreased carrying-capacity of the acreage in grass, the lessened root-penetrative power of English grass-seed. There needs no amplification or repetition of these facts, but further proof of the same tendency between 1908 and 1929 is afforded during that period by the negative results of the turfing and grassing of the cold, damp, southern and eastern aspects. In 1908 three-quarters of such ground was still practically unused; now, owing largely to cattling and fencing, it has come into grass, yet there has been no corresponding increase of stock, no corresponding increase of wool; at the best matters have remained *in statu quo*. To reiterate, while 50 per cent. more ground has become available for stock, no increase of stock has taken place. This great spread of grass area has enlarged the sum total of food value by nothing. In spite of the added grass surface, the aggregate of grass-blades throughout the year has not augmented.

In my former paper occurs the following sentence: "For many seasons the station has passed successively through the phases of rapid increase, slight increase, balance, decrease, and lately rapid decrease." Since then—since 1908—the carrying-capacity of Tutira has remained stationary, the grassing of the colder, wetter portions just about counterbalancing the lessened exuberance of the turf elsewhere. The inability to strike of surface-sown English grasses even prior to 1908 has been touched upon. It is more marked now than ever. After felling and firing the manuka which still persists on the lighter soils, experience has shown the absolute futility of seed sowing. Such lands will grow danthonia, *Microloena stipoides*, suckling clover, *Festuca myuros*, and clustered clover, but for years they have been rye and clover sick. Spring, too, has been postponed from mid-August to September or later. The deepening green of the warm hillsides, the stir of the innumerable pointed blades which used to mark the turn of the shepherd's year, are now retarded by eighteen or twenty days; the primal exuberance of the turf is gone.

FOREIGN GRASSES.

Twenty-one years ago, of the thirty-four foreign species of grass known to me on Tutira, only nine or ten had first touched land by the deliberate will of the owner; the others had reached the run as stowaways. Now these stowaways come at longer intervals. During the last twenty-one years, indeed, only three additional grasses have thus colonized the station—namely, *Glyceria fluitans* (sweet floating-grass), *Poa trivialis*, and *Eragrostis Brownii* (bay-grass).

Though but a few of these aliens require comment here, the full list may be recorded again as follows: *Paspalum dilitatum, Panicum crus-galli, Setaria viridis, Phalaris canariensis, Anthoxanthum odoratum, Phleum pratense, Alopecurus pratensis, Polypogon monspeliensis, Agrostis alba* (Bentham and Hooker), *Holcus lanatus, Aira caryophyllea, Cynodon dactylon, Briza minor, Dactylis glomerata, Cynosurus cristatus, Poa annua, Poa pratensis, Festuca elatior, Festuca ovina, Festuca rubra, Festuca myuros, Festuca bromoides, Bromus mollis, Bromus racemosus, Bromus unioloides, Lolium perenne, Lolium italicum, Agropyrum repens, Hordeum murinum, Sporobolus indicus,* Johnson grass.

Paspalum is of little local value—frosted in autumn, and unnecessary in summer because of our big rainfall. In unmanured pumice, however, though root-bound, it will persist for years, and in that same pumice, worked but still unmanured, will revive and make a temporary show. *Anthoxanthum odoratum* (sweet vernal) has in half a century not moved 400 yards from its birthplace; there has been no attempt at colonization elsewhere on the station. *Phleum pratense* (timothy) has never spread from one or two self-chosen spots on dampish peat. *Alopecurus pratensis* (meadow foxtail) I have not seen locally for years.* *Holcus lanatus* (Yorkshire fog), once an important grass on Tutira, yearly becomes more scarce; on top-dressed pumice, however, the plant is by no means inclined to allow itself to disappear or to suffer domination; during the dry summers of four or five years ago, when on certain light lands almost everything failed from lack of moisture, great clumps of fog survived and seeded freely.

Dactylis glomerata (cocksfoot) still maintains a certain grip on the run, especially on southern and eastern aspects. On deliberately unstocked paddocks even of moderate fertility, if allowed from time to time to run to seed and then to be trampled flat with cattle (supposing there was a single sheep-farmer in the whole of New Zealand great-hearted enough to forgo the immediate gluttonous grazing of his grass) cocksfoot would, I believe, often resume possession. On the other hand, facing the sun—facing north and west—it requires as a companion plant the blackberry. The stubbed, goat-clipped growths just sufficiently shelter its crown, and thus enable it, and rye, and sometimes even prairie-grass, to breathe and live—a curious example, indeed, of plant association: *Cynosurus cristatus* (crested dogstail), which arrived on its own account in very early days, still continues to spread. *Poa pratensis* has specialized in cow-pats, climbing these comfortable cushions until again sinking into reinvigorated flatness.

* Last summer, however, near St. Lawrence, in Hawke's Bay, its tall, soft, silky seed-heads were very plentiful on the enclosed roadsides. *A. geniculatus* I have come across once in my life, in Poverty Bay, inland from Whatatutu.

Concerning *Festuca myuros*, for twenty-one years I have been repenting of my insulting remark that it was almost useless; for twenty-one years I have been trying to live down that unfortunate phrase. On the contrary, the more closely I look into the turf of good, bad, and indifferent lands—the more I dissect scraps of sod—the greater value do I put on the winter growth of this small species. It is a grass that competition has forced to flourish in late autumn and winter; it must grow then or never; given space it spreads its skirts into a delightfully green clump; it fills on the hills every vacant space with innumerable seedlings. If we knew enough we should discover this species fulfilling some important function in the economy of nature. In summer this excellent little annual, known as hair-grass, spindles out to nothing By October it has bolted into a repulsive series of wiry unappetizing stems; by January it has become as insignificant as the equally important *Trifolium glomeratum*. The immense, the enormous aggregate value of these plants is overlooked because individually they are small.

Until five years ago I had classed *Bromus unioloides* (prairie-grass) as only fit for deep, heavy soils. In the laying-down, however, of a light-land paddock prairie-grass was inadvertently sown with locally saved cocksfoot. This paddock has now been down five years, but instead of dying out prairie-grass has increased. True it is that the field is often spelled and chiefly used by cattle; nevertheless, given a fair show, prairie-grass, up to a point at any rate, will thrive on poor soil top-dressed.

Alas for *Lolium perenne* (perennial rye-grass), which in the "seventies" and "eighties" was sown with quite a childlike simplicity, an infantile faith, on lands good or bad alike. Nevertheless, however much in these degenerate days rye and white clover may have thinned out, certainly for many years and over many thousands of acres they were suited to the virgin soil of our splendid province. I recollect in the middle "eighties" on Tutira the hillsides grey with clover-heads—grey with blossoms where now hardly a leaf can be found by diligent search. Rye-grass, too, has gone except on sheep-camps, and now only is to be found naturally on alluvial flats. Even on sheep-camps—heavily manured sheep-camps—rye in dry seasons no more than holds its own against danthonia. There, as elsewhere, the surface has changed from sponge to slate.

The manner of arrival of rye-grass on Tutira is a proof of the distances seeds were carried by neophytes and scholars from the mission stations of early times. Ripora, afterwards the mother of my friend Aparahama Anaru, was as a girl educated at the Bay of Islands She it was who first brought rye-grass to Tangoio, about 1834 or 1835. It had been gathered at Paihia, either from one of the newly sown missionary fields or saved from plants that had already spread about the Native quarters. Stowed away safely during the overland march, guarded from salt water during the long canoe voyage south, on arrival neglected in the whare at Tangoio, the cloth of the containing bag rotted and torn, the once treasured seed was finally flung out in forgetfulness. There, falling on fertile soil, it germinated, like the rice and barley cast forth by Robinson Crusoe before the entrance of his cave. The exact manner of its ultimate arrival at Tutira can only be surmised, but probability points to the equine

stomach. It is curious to reflect that this, the most valuable grass in the province, should have reached Tutira long before the run was taken up, and years before a grain of grass-seed had been purposely sown on the station.

Poverty Bay rye-grass is also directly descended from missionary sources The late Mr. J. N. Williams has told me it was first noticed shortly after the shipment of a couple of cows from the Bay of Islands to the later-established headquarters of the mission on the Waipaoa River. Mr. Williams's brother, the late Bishop of Waiapu, has informed me, too, how rapidly it killed out the native *Microloena stipoides*, then in possession of the whole of the Poverty Bay flats.

Lastly we come to *Sporobolus indicus* (ratstail), one of the two grasses that on the poorest pumice grit in pre-superphosphate days completely clothed it and formed a palatable sward. This it is enabled to do by its enormous depth of root. These roots I have photographed 24 in long. Owing to the heavy cattling of the run nowadays, ratstail has of late spread more slowly. It does, however, still increase, for during summer stock feed lightly on the least good land. There year by year its scrubbing-brush patches expand. It germinates badly, and on light soils, because of its toughness, is pulled out wholesale.

For Chewings fescue, also, I must say a good word. I respect rather than love the plant. Chewings, nevertheless, and ratstail are the only species that in pre-super days were able to closely and densely carpet pumice-lands.*

CLOVERS.

Of members of the pea-flower tribe grazed by stock the following had established themselves before 1882: Nonsuch clover (*Medicago lupulina*), toothed burr clover (*M. denticulata*), spotted burr clover (*M. maculata*), field melilot (*Melilotus arvensis*), white clover (*Trifolium repens*), suckling clover (*T. dubium*), red clover (*T. pratense*). Between 1882 and 1902 three additional species appeared: Haresfoot clover (*Trifolium arvense*), alsike (*T hybridum*), hop trefoil (*T. procumbens*). After 1902 I have noted the arrival of the following: Reversed clover (*Trifolium resupinatum*), strawberry clover (*T. fragiferum*), clustered clover (*T. glomeratum*), suffocated clover (*T. suffocatum*), trigonell (*Trigonella purpurascens*), and striated clover (*T. striatum*).

Some of these, such as spotted burr clover and field melilot, are either actually distasteful or not particularly palatable to stock. Others are in the leaf aggregate of trifling import. Nonsuch, though an excellent plant, is not suited to open or poor soils. Toothed burr clover, hop trefoil, and reversed clover are rarely seen. Strawberry clover grows only on insignificant areas of sandy silt; suffocated clover, though I believe it would thrive, has so far been represented by one single specimen. Trigonell has but recently appeared—a small patch skinned bare to the very roots by sheep.

An interesting fact regarding these clovers is that, with the exception of red clover, all of the sixteen species enumerated have arrived "by

* There are large stretches of Tutira, now out of my hands, which still, after eleven years of no manure, are deeply green in Chewings fescue and subterranean clover.

themselves," for both white clover and suckling were on the station long previous to the earliest sowing. I mean that in the first place they have not been purposely scattered on the hills by man. They have reached the run, so to speak, by their own scheming: they have been shaken from old sacks; they have smuggled themselves on to Tutira among purchased grasses; they have been carried in the stomachs of stock. Afterwards some of them—as also others mentioned elsewhere, such as subterranean clover and several *Lotus* species—have deliberately and on a great scale been distributed over thousands of acres.

Native Grasses

Following are the native grasses found on Tutira: *Isachne australis, Microloena stipoides, Microloena avenacea, Hierochloe redolens, Echinopogon ovatus, Deyeuxia Forsteri, Deyeuxia quadriseta, Dichelachne crinita* and var. *intermedia, Deschampsia caespitosa, Trisetum antarcticum* and slender form, *Danthonia semiannularis, Danthonia pilosa, Arundo conspicua, Arundo fulvida, Poa anceps, Poa caespitosa, Poa Colensoi, Poa imbecilla, Agropyrum multiflorum, Agropyrum scabrum, Asperella gracilis.*

We can follow in a few paragraphs their history during the last twenty-one years. Danthonia must be considered first of all. Certainly on the hard and ever-hardening hillsides, and especially on the hotter aspects, this species now dominates the land. From a few plants here and there in 1882, surviving on trampled Maori tracks and pa sites, it has developed into the most prominent grass on the station. I write now, as I wrote in 1908, not sure which is the type *D. pilosa* and type *D. semiannularis* and which but varieties. In one good local form the leaves are broad, flat, pilose, and of a notably deeper green. Even twenty-one years ago these grasses had clothed many hundred acres, and since that date there has again been a great increase. In my paper of 1908 there is less said about their value as fodder plants than about their arrival and spread. This signifies, I suppose, that at that date the English grasses were still fighting a rearguard action; they had not yet been in great degree overwhelmed and submerged. Be that as it may, nowadays on all hard soils danthonia has altogether displaced the early-sown aliens, and is also more slowly and more unwillingly thickening on the great spongy centre of the run. It has come to this, in fact, that were stock to be removed for six months nine-tenths of the original Tutira sheep-station would be yellow in danthonia seed-stems.

Microloena stipoides, though enormously more plentiful than in the "eighties," when it too survived on trampled ground and the ringworm roundels described, has remained stationary during the last twenty-one years; land that might have fallen to its lot has been seized by the more virile danthonias.

Of the remaining native grasses found on Tutira, four others only need be discussed *Dichelachne crinita* grows equally well on hard or soft soils, good or second-class; where spared by stock (as when growing among low bracken) its handsome erect plume of feathery seed-head at once attracts attention. It will maintain itself even on such closely cropped areas as sheep-camps, and was one of the three species growing on the late Mr. J. N. Williams's sample strips of turf collected from the finest Hawke's Bay pasturages and replanted for

observation purposes on the fertile Hastings plains Thus to survive amid English grasses on rich soils argues an abundant vitality. When trying out various natives in my experimental garden *Dichelachne crinita* reached the height of 5 ft 6 in, the seed-stems standing erect like fine-drawn straw.

Poa anceps has certainly not fulfilled the prophecy that it is one of the native species which would eventually take possession of certain recently fired lands. Though in the "eighties" it covered very sparsely several hundred acres of accidently burnt rimu forest, it was soon smothered by bracken, and has now in this locality long disappeared. On country of 2,000 ft and upwards it is, however, an important factor in the turf. Its growth and appearance is that of a very strong broad-leafed *Poa pratensis.*

Poa caespitosa, though locally of no account as a fodder plant, is interesting because it at one time covered several hundred acres on the higher inland area of Tutira It had, however, even in 1882 been almost destroyed by the starving merino wethers that then ran on this country. The Heru-o-Tureia Block on which it flourished must have been the limit of its eastern spread from the Taupo plains, which, though now brown and red with other growths, were originally yellow with Poa tussock. Brown-top (*Agrostis tenuis*), purposely sown, has of late years taken possession almost exactly of these low rolling tops and flats once occupied by *Poa caespitosa*

What I termed in my paper of 1908 *Agrostis alba* (Bentham and Hooker), and which should be *Agrostis palustris* (E. Bruce Levy, *N.Z. Journal of Agriculture*, February, 1924) must be exceedingly distasteful to sheep. One small patch existed, and probably still exists, on the heights of the Maungahararu Range. Even in the stock-starvation days of old no beast would nibble it; summer and winter, rank and untouched, it was visible chains distant. A later arrival by scores of years—a form probably of this worthless species—has proved equally unpalatable in paddocks once in turnips; no stock will touch it under any circumstances. The purposely sown *Agrostis,* however, that has thus after fifty years become heir to the Poa tussock, is Levy's *A. tenuis* (*Journal,* February, 1924). On this infertile gritty soil it has behaved precisely as he describes—it has become "inclined to dry out in the summer and get sodbound, so that the yield becomes very low." But although a half-starved species cannot but appear a failure, at any rate no grass that I can think of would have done better. Brown-top, under whatever designation sold and bought, was never sown on the limestone ranges of Tutira: on them to this day, indeed, it is not prominent.

Agropyrum scabrum and *A. multiflorum* may be for the purposes of this paper treated as one. This is the Canterbury blue-grass, credited in the Mackenzie Country and elsewhere with great fattening-qualities, the seed so oat-like in quality that horses taken straight from the paddock could be galloped hard, nay, for miles raced without injury ("Tutira," p. 104). So highly was this grass valued that over sixty years ago seed was sent to Messrs. Sutton in England; nothing, however, was to be learnt of their experiments when I wrote for information. Sheep are fond of the noticeably blue blades, for only

on rough and unstocked lands do they show up. Everywhere throughout Hawke's Bay, on steep road-cuttings or cliffs, do its tall seed-heads call for notice. I think it probable, however, that the great fattening-qualities ascribed to it in the Mackenzie Country lie in the seed rather than the blades. Twice I have planted or sown considerable plots of *Agropyrum multiflorum*—the better plant of the two—and twice accident or ill fortune has marred the experiment.

General Observations.

Such are the grasses and fodder plants, native or foreign, sown deliberately or coming as stowaways that make up the Tutira turf. Were the limestone hill ranges in imagination dissected horizontally and sheep-camps excluded, species and forms of danthonia would be found covering 75 per cent. of the tops and higher slopes; here and there, looking on to the sun, ratstail is established; rye-grass and white clover have almost disappeared; a little cocksfoot and fog survive in the damper spots; *Poa pratensis* holds; *Festuca myuros* is thick everywhere, also *Trifolium glomeratum*, an equally early-flowering plant with the invaluable, ubiquitous suckling clover (*Trifolium dubium*); *Microloena stipoides*, though dominated by danthonia, is still widely distributed; crested dogstail fully holds its own.

Crested dogstail, suckling clover, and *T. glomeratum* till December supply, I imagine, the condition of the stock, the other plants not more than maintaining them in good store order. There are to be found also in this type of turf *Pelargonium australe*, four species of *Geranium* (*sessiliflorum*, *microphyllum*, *molle* and *dissectum*); sorrel; hawkweed; two late arrivals, *Linum gallicum* and *Galium parisiense*; *Wahlenbergia gracilis*; *Carex Colensoi*; pearlwort; *Vittadinia Australis*; a harmless creeping St. John's wort; *Linum australis*; chickweeds; *Cotula*; and certain thistles.

On the lower portion of the range, below our imaginary line, will still be found—though thin indeed compared with early days—rye, white clover, cocksfoot, and fog, more *Poa pratensis*, more ratstail, a stronger growth of crested dogstail, more plentiful suckling, and *T. glomeratum*. Thistles also will be more numerous. Generally speaking, in fact, the damper, heavier soils hold the better grasses for the longer period.

It is perhaps worth while pointing out here that although one of the three *Lotus* species sown on ploughed and supered ground has flourished exceedingly, I have not yet noticed even a single seedling of it on the hills. This is the more remarkable, for the small seeds of *Lotus hispidus* must be carried afield in tens of thousands in the stomachs of shifted stock. Burnet, though persisting for season after season in ploughed land, has never strayed farther.

Subterranean clover, though holding well throughout seventeen or nineteen seasons of neglect on poor unsupered lands, makes no attempt at colonization.* Subterranean clover, which I have seen only

* In its company, by the by, has appeared a very worthless looking, hard, stubby, stemmy fellow-member of the *Trifolium* family, evidently near enough in its seed similarity to pass itself off as the genuine article; it has failed to maintain itself.

as a miserable weed wild on the Sussex coast, offers a shining example of the importance of allowing no vegetable species to perish. Under new conditions it is impossible to predict the potential value of a plant.

To reiterate: Fifty years ago the limestone and papa portion of Tutira was sown in rye-grass, white clover, and cocksfoot, now 75 per cent. of it is in native grasses and inferior aliens. On the conglomerate and sandstone formations fog, goose-grass, and suckling formed the original mixture; nowadays on hills of this quality danthonia rules, with suckling clover second in command—for the wonderful merit of this latter plant lies in the fact that, far from decreasing after half a century's grip of the ground, it persists with pristine exuberance.

The important plants have been sufficiently emphasized. To obtain an absolutely accurate conception of the station turf the intelligent reader has but in imagination to scatter very sparingly according to aspect and soil the additional species listed, and he has the exact value of the present grasslands of Tutira.

As on the Downs in England or on the grassy hills of the Scottish borders, a condition of stable equilibrium is being approached. On Tutira, as in Britain, similar conditions have produced or are producing similar results; in both, the lands in question have been wooded, have later been stinted of leaf-mould for centuries, have been drained of the original mineral plant-foods—not present in vast quantities. Normality has been actually reached in the Old Country, and is approaching in such fifty-year turfs as we have been discussing.

Not long ago grass-farmers would have had to content themselves with merely marking time, utilizing to the full deep-rooting species such as ratstail, and self-feeding plants like suckling and *Trifolium glomeratum*. At the best it would have been a dreary business watching the irretrievable deterioration of their pasture lands. Nowadays, with excellent tuition from our New Zealand agricultural authorities and with cheap fertilizers, they can confidently look to a brighter future.

SHEEP FLOCKS IN NEW ZEALAND, 1928 AND 1929.

Size of Flock.	Number of Flocks.	
	Year 1928.	Year 1929.
1–200	5,809	5,551
201–500	6,457	6,364
501–1,000	5,957	6,313
1,001–2,500	5,415	5,975
2,501–5,000	1,606	1,724
5,001–7,500	416	440
7,501–10,000	157	173
10,001–20,000	139	146
20,001 and over	26	26
	25,982	26,712

ERADICATION OF TALL FESCUE.

METHODS PRACTISED IN THE MANAWATU DISTRICT.

R. P. CONNELL, M.A., Fields Division, Palmerston North.

CERTAIN of the highly fertile drained swamp areas of the Manawatu, which were rightly regarded as strongholds of tall fescue (*Festuca elatior*) that had invaded the land in a vigorous manner to the practical exclusion of all other species, have recently been converted into highly productive farms. These farms, under good management, are capable of carrying milking-cows sufficient to return an average production of over 200 lb of butterfat to the acre, or a corresponding number of ewes or mixed grazing-stock, whereas when the tall fescue was in possession of the land it could not be utilized satisfactorily either for high-class dairying animals or for other wet stock.

The process of converting the land overrun with fescue into land carrying high-class pastures in which rye-grass and clovers are prominent is one of considerable economic importance particularly in view of the fact that there still exist in the Dominion extensive areas which are invaded by fescue. The essential features of the system of fescue-eradication employed on those Manawatu farms, the present-day appearance of which bespeaks the suitability and success of the methods, may be briefly stated as follows:—

(1) Preliminary destruction of as many as possible of the fescue-plants in possession by turning over the fescue growth with the swamp-plough, and by subsequently cultivating with disk harrows, &c., for the purpose of destroying all possible plants which escape death as a result of the ploughing. There is evidence that the first ploughing-down of the fescue should be carried out as soon as the land is sufficiently well drained to allow of the passage of the implements over it: the ploughed-down fescue clumps decompose more completely in poorly drained than in well-drained land.

(2) Destruction of the countless viable tall-fescue seeds which are in the soil when the fescue-plants in possession have been eradicated, and which would rapidly bring about complete reinvasion by the fescue were they not properly dealt with.

(3) Prevention as far as possible of the introduction of further supplies of tall-fescue seed at any stage during the time the original fescue-plants and fescue-seeds are being destroyed. If the introduction of further supplies of seed is not avoided, the work of completely ridding the land of fescue is indefinitely prolonged.

There are thus three objectives: (1) the destruction of established plants, (2) the destruction of seeds or of young plants arising from these seeds, and (3) the prevention of reseeding. Persistent trouble with fescue arises more often from failure to give proper attention to the second and third objectives, which are the seemingly minor ones, rather than from failure to achieve the first objective—the apparently major one.

The system of control under consideration not only rids the land completely of fescue, but also brings in such cash returns as to pay for itself as it proceeds. Hence eradication can be carried out without

the direct outlay of additional capital. It is neither possible nor desirable to give a detailed description of this system indicating how it should be applied in all cases. This is because the system is usefully made to vary from farm to farm according to many circumstances, chief of which possibly is the financial position of the farmer operating it. Usually the farmer can easily work out the detailed application of the system suited to his own circumstances once he knows the important and essential steps in it.

The important and essential points in the system under consideration are—

(1) Removal of timber as completely as possible is the first step after drainage, and this should be affected at least to such an extent as to allow of cultivation being satisfactorily carried out. At times, over extensive areas yet to be reclaimed from fescue domination, the removal of timber will prove a formidable task which will tax the labour and financial resources of those engaged in it. However, it is difficult to see how land can be economically and permanently cleared of fescue unless so little timber remains that satisfactory cultivation is possible.

(2) The next step is swamp-ploughing, which calls for the use of a tractor or a six-horse team, and for the turning of a furrow 18 in. wide. The aim should be to turn over and bury as much as possible the crowns of the fescue clumps. The complete turning-over of the clumps may be facilitated by grazing back the growth until only the crowns of the clumps remain. Steers may satisfactorily be employed in grazing back the growth if they are crowded on the fescue for a short period, then grazed for a spell on growth free from ergot, then returned to the rank fescue for another short period, and these changes with the steers repeated until only the crowns of the fescue remain. Large tussocks which the plough fails to turn over effectively may advantageously be turned down with a spade. The land having been ploughed should be further cultivated with disk harrows, &c., so as to provide a satisfactory seed-bed for the crop which is to be sown as soon as the seed-bed has been obtained. In working the ground to produce the seed-bed tripods often are preferable to tine harrows or spring-toothed cultivators, which may undo the work of turning down the fescue clumps.

(3) The third step is the growing of a crop which tends to eliminate the fescue. The first crop grown after the fescue has been ploughed down may be a temporary or short-rotation pasture, a cereal mixture such as oats and tares, partridge peas, or one or more of several standard forage crops such as swedes, soft turnips, chou moellier, mangels, or potatoes. It is highly desirable that this crop should have one at least of two characteristics: either it should be dense and rapid in growth so as to exert a smothering effect on invading plants, or it should be of the cleaning class of forage crops which allow of the ready destruction of invaders by intertillage. One of the principal objectives of such a crop is the destruction of fescue-plants which are likely to arise from undestroyed portions of the original clumps or from seed in the ground. Another principal objective is the provision of a crop which will fit in well with the stock or the cash requirements of the farm. For instance, if pigs are being kept on a fairly large scale,

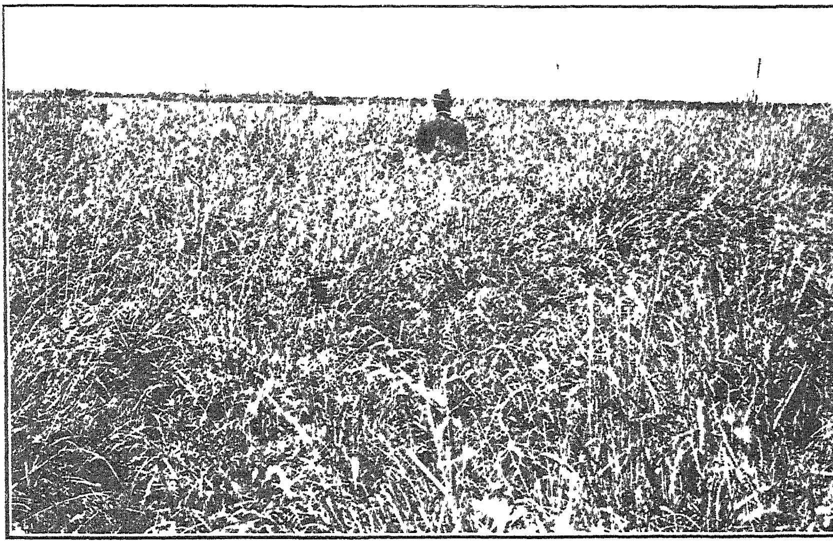


FIG. 1. TYPICAL GROWTH IN NOVEMBER ON LAND INVADED BY TALL FESCUE.

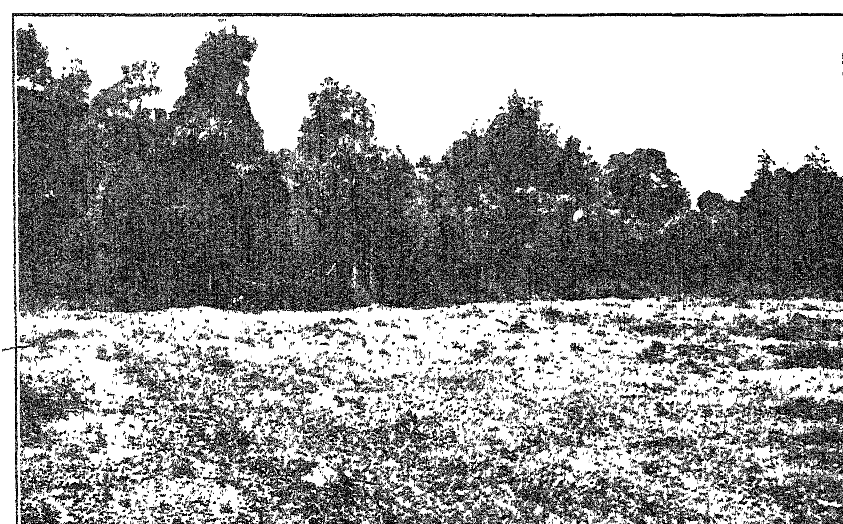


FIG. 2. FESCUE-INFESTED LAND AFTER SWAMP PLOUGHING IN THE SPRING.

This area was previously in the same condition as that shown in Fig. 1. Although it had been disked twice it was still uneven. The mixture of bush and fescue in the background has not as yet received any attention. In clearing this, removal of the timber, both standing and fallen, is the first step.

[*Photos by H. Drake.*

partridge peas sown at the rate of $2\frac{1}{2}$ bushels to the acre may at times be grown profitably ; if sufficient pigs to justify this crop are not being kept it could often be replaced advantageously by such a crop as oats and tares. Again, if market prospects and facilities are favourable, potatoes may prove more advisable than mangels or swedes. At all times in the raising of such crops careful attention should be given to the labour resources of the property The mere fact that a crop is suited to suppress fescue is not a justification for it ; it should also be a sound financial proposition having regard to the property as a whole.

(4) If the first crop after the initial ploughing is a suitable one, such as oats or rape, pasture may be sown down with it Otherwise as soon as the first crop has been removed generally it is found advisable to immediately plough, suitably cultivate to provide a seed-bed, and sow down a seed mixture designed to produce on fertile land a short-rotation pasture. Rye-grass, white clover, red clover, cocksfoot, and timothy are being made the main constituents of such pastures. It may happen, however, that the requirements of a particular farm call for delay in the sowing-down of pasture When this is the case a second forage crop may follow the first one, but care should be taken that it is of either a smothering or a cleaning type, since the eradication of the fescue is the primary objective.

(5) It is the rule to find that fescue appears in the pasture produced after the first ploughing. It may be expected that eventually the fescue-plants forming the secondary invasion will become so numerous as to make it necessary again to plough and cultivate the land in order to bring about their destruction economically. When this second ploughing becomes necessary the ploughed ground is sown in one of the special forage crops of the cleaning or smothering type already mentioned. How soon the necessity for the second ploughing arises depends on several factors, chief of which are (*a*) the success attending the initial ploughing and the first forage crop as agents of fescue-eradication ; (*b*) the type of stock being carried ; (*c*) the steps taken, apart from stocking, to check the rate of secondary invasion.

In regard to the type of stock, store cattle such as bullocks or dry sheep which it is not desired at the time to fatten can be made to graze so hard as to punish the fescue, check its development, and markedly delay the date when the second ploughing-down of fescue will become necessary. On account of this there has arisen occasionally the impression that fescue can be eradicated by bullocks or sheep. The true position is that the fescue is controlled but not eradicated. And if the land on which it is so controlled were devoted to dairying or to fat-lamb production the fescue would rapidly assert itself and take possession within a relatively short time. From this it follows that while dry stock cannot be looked to as a means of eradicating fescue, they can at times be made extremely useful in controlling it, until such time as one is in the position to do the ploughing necessary to so free the land from fescue as to make it safe for dairying or for fat-lamb production. In other words, while land is being reclaimed from fescue, mixed stock-farming has much to recommend it, particularly if the farm is one of considerable size.

The rate of secondary fescue invasion can also be checked substantially if time and care is given to the digging-out with the spade of

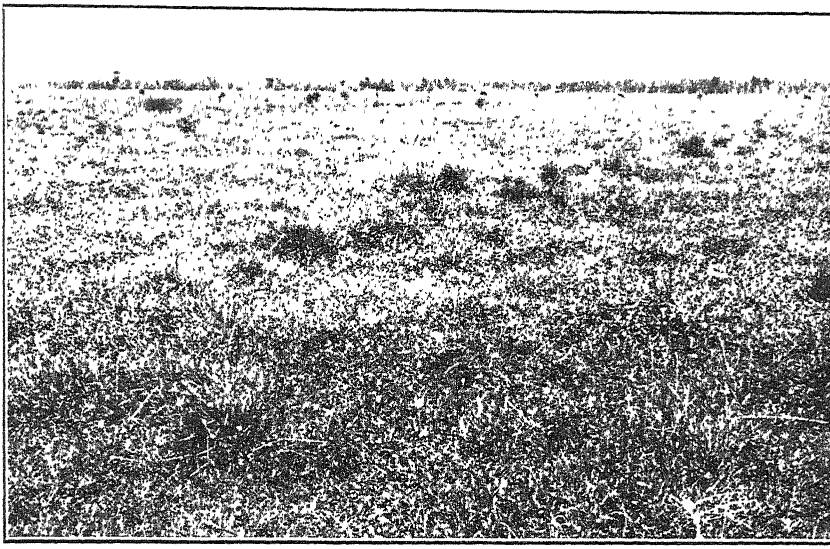


FIG. 3. FIELD SOWN WITH GRASS IN MARCH, 1928, RIGHT AFTER SWAMP PLOUGHING AND CULTIVATION.

Despite the fact that stray plants of fescue have been removed with the spade, it can be seen that fescue is now fairly prominent, and ploughing will soon be necessary. It is intended to plough the area in March of this year.

FIG. 4. LAND AFTER RECEIVING ITS SECOND PLOUGHING.

In November, 1929, this area was sown in soft turnips in the foreground and in mangels and potatoes in the background. When these crops have been removed the land will be ploughed and sown in pasture which, it is expected, will be permanently free from fescue.

[*Photos by H. Drake.*

as many as possible of individual invading fescue-plants. Indeed, some hold that one ploughing-down of the fescue is sufficient if proper attention is given to the digging-out of invading plants as they appear. This may be true of land which is not of the type that constitutes the real fescue strongholds. But those with experience on the rich drained swamp-land are of the opinion that the eradication of fescue by the digging-out of invading plants, while possible, proves so costly in labour as to be a method of eradication much less desirable than that which involves the extra ploughing as herein described.

An additional aid in checking the rate of secondary invasion lies in the prevention of seeding of all fescue-plants which have established themselves. Prevention of seeding may be accomplished by hard grazing or by the use of the mower to top the plants at suitable seasons.

(6) Even when all practices already referred to have received due attention it is often necessary to plough the land a third time to bring about absolutely complete fescue-eradication. It is impossible to fix when this third ploughing should be carried out, as much will depend on the results of the prior treatment. If farm conditions permit it is well to carry out this ploughing in the autumn, and to precede it by a spring skim-ploughing, followed by regular summer surface tillage with disk harrows, &c. The skim-ploughing and summer surface cultivation greatly facilitate the complete destruction of the fescue.

(7) Once a field has been freed from fescue great care should be taken to prevent the reintroduction of fescue-seed from outside sources. Hence drains and similar places from which fescue cannot readily be eradicated should be fenced along all sides. At times areas so fenced could very advantageously be planted with trees. If suitable trees are used they will not only act as shelter-belts and eventually provide useful and valuable timber, but they will also destroy the fescue in their vicinity by the shaded conditions they create.

(8) Right through all grazing subsequent to the first ploughing-down of the fescue good grazing-management such as would be productive of a close dense sward will materially lessen the trouble from fescue. Hence, as mixed grazing with sheep and cattle admits of better grazing-management than grazing with cattle alone, some of those who have been most successful in dealing with fescue favour the running of some sheep, even though cattle are outstandingly the dominant consideration.

An important feature of the system of fescue-eradication herein described is that it may be made to vary greatly according to the circumstances of the farm and of the farmer operating it. It may be so greatly varied that it can truly be said to be characterized both by flexibility and elasticity. These in themselves are valuable merits, in that their presence means that one is not bound to any cast-iron routine, but may bring in any modifications from time to time that market conditions call for. For instance, special forage crops have to be grown, but the suitable crops are so wide in range that one could swing from beef-production to sheep-production, to butterfat-production, to pig-production, as replacements of or adjuncts to one another, while the process of fescue-eradication was being effectively carried out.

The outstanding considerations in respect to this system of fescue-eradication are—(1) It has proved in practice to be effective, (2) it finances itself, (3) it is highly elastic and flexible, and so it can if necessary be greatly modified to meet unforeseen market developments.

It is a pleasure to record my thanks to those farmers who readily and carefully gave me valuable information in regard to their actual experience in fescue-eradication. In this connection I would specially

FIG. 5. FIELD CLEARED OF TALL FESCUE AND NOW CARRYING A HIGH-CLASS CLEAN PASTURE.

This pasture is expected to remain permanently free from fescue. It has received three ploughings: in 1926 it was ploughed and sown in swedes; in the spring of 1927 it was ploughed and sown in oats; early in 1928 it was ploughed after the oats, and sown immediately in permanent pasture. [Photo by H. Drake

mention Mr. S. R. Young, of Opui, whose farm as it stands to-day is a testimony to the success of his methods. A feature of particular interest attaching to the accompanying photographs is that they depict the stage various measures of fescue-eradication had reached on Mr. Young's property towards the end of November last.

Finally, it must be remembered that the foregoing matter applies particularly to tall-fescue land in the Manawatu, and may not be suitable for other districts where fescue is infesting different types of soil.

Actinomycosis in Cattle.—The animals condemned for this disease and for which compensation was paid in 1928–29 were 685, as against 628 the previous year, distributed as follows: Canterbury, 63; Auckland, 380; Wellington, 182; Otago, 60. In addition to those animals slaughtered for the disease a considerable number were treated with potassium iodide with satisfactory results. The annual report of the Live-stock Division states that only in open cases or in those which have advanced so far that treatment is useless is slaughter carried out, and wherever possible owners are advised to seek advice early, in order that the best results may be obtained and that the lives of valuable animals may not be sacrificed.

PARTURITION IN BOVINES.

(Concluded.)

J. LYONS, M.R.C.V.S., Director of the Live-stock Division, Wellington.

Malpresentations—*continued.*

All Four Legs presented.

This is a case where delivery is easily effected when it is in the hands of the skilled operator, although it can be made a very difficult one by undue interference. To effect delivery the operator should make certain which are the fore and which are the hind legs. This is easily accomplished by inserting the hand to discover which are the knees and which are the hocks, and the hind limbs should then be secured by ropes fastened round the fetlocks. The hand should again be inserted and the fore legs pushed back, meanwhile traction being applied alternately on the hind limbs by an assistant and delivery brought about in this way. In a case of this kind, if traction is applied indiscriminately, more especially to the fore legs, the limbs become jammed in the passage, when it will be found impossible to return them to the original position and the only method of delivery with safety to the mother is to remove the fore legs, when, by bringing the hind legs forward over the brim of the pelvis, delivery can be effected. Directions for removing the fore legs were given on page 24 of last month's *Journal*, in connection with the presentation of two legs with head turned back.

Malpresentation of Twins.

In the majority of cases no difficulty is experienced by a twin birth. It sometimes happens, however, that both twins are presented together and become blocked in the passage. In such cases both may be normal presentations, both may be breech presentations, or, what in my experience has been most common, one calf may come head first, while the other is presented tail first.

Whatever is the position, care will need to be exercised that pressure is not applied to those parts presented and the calves jammed further into the passage. The hand and arm should be inserted, and the calf which is farthest into the passage should be selected to be brought away first. The legs should be roped, and care must be taken that the legs belonging to the same fœtus are secured. This can be done by following each leg right up to its insertion. When the limbs are secured the other fœtus should be pushed back as far as possible and delivery effected.

The other fœtus can then be delivered in turn. A case such as this is rendered more difficult if one or both presentations is not natural. However, every malpresentation should be adjusted as with a single birth before attempting to bring about delivery.

Other Difficult Conditions.

Dropsy of the Abdomen of the Fœtus.

It sometimes happens that in spite of traction applied by those in attendance delivery cannot be accomplished, although the presentation

is a natural one in every respect. In such a case undue force should not be exercised, and the operator should make an examination to discover the cause of the obstruction. In passing the hand between the wall of the womb and the fœtus it will be found that the belly of

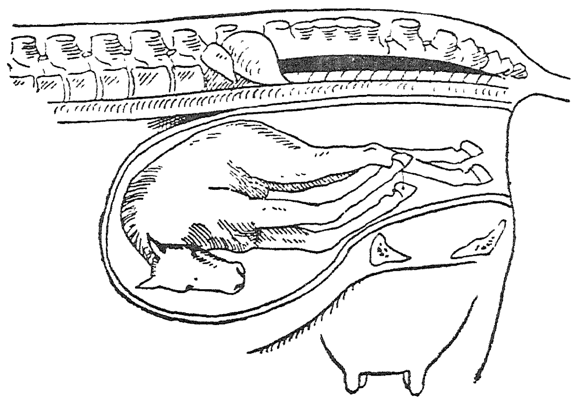


FIG. 5 ALL FOUR LEGS PRESENTED.

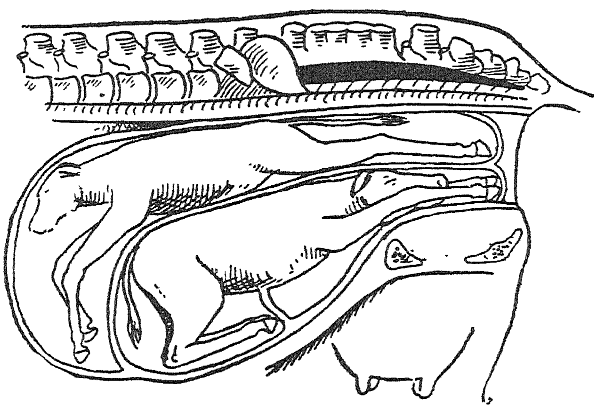


FIG 6. TWIN CALVES: LOWER, NORMALLY PRESENTED; UPPER, HIND LEGS FIRST.
[*After H. Thompson.*

the calf is greatly extended. This can be relieved by opening the cavity with a knife, when the fluid will escape, after which delivery is easily accomplished.

Fœtus with Two Heads.

Considerable difficulty is experienced in delivering such cases, on account of the double head being too large to allow it to be manipulated through the passage. In this case the head must be removed. If

the case has not been interfered with and the fœtus is inside the womb, the head can be removed with an ecraseur specially made for the purpose. Too frequently, however, interference has taken place, when the head becomes firmly jammed in the passage. In such circumstances the hands of the operator should be well oiled and a wire cord introduced around the neck as described in connection with practice in cases of contraction (see last month's *Journal*, bottom of page 27), and the head removed, after which the remainder of the calf can be removed In a case like this where the head is sawn off, without any covering to protect against the bones, the hand should be introduced and held over the neck until it has reached the outside.

Torsion of the Vagina.

In this case the cow shows all the appearance of calving, but without any sign of the fœtus. In introducing the hand it will be found that there is a twist in the passage This may be complete or it may be only a partial one If the former, considerable difficulty will be experienced in effecting delivery, as the passage is completely blocked and does not admit of any part of the fœtus being touched

In this case the animal must be secured and rolled over on its back to the other side, when the twist will right itself and delivery can be accomplished. While the cow is being rolled over the operator should keep his hand in the passage to ensure that the turning is in the right direction If the animal is being rolled in the wrong direction the twist will tighten on the hand, in which case the rolling should be reversed.

When the twist is only a partial one the hand can be introduced and the calf's legs secured. It should be the object of the operator to get these through the twist when by a rolling movement the womb may slip back into place, or, as frequently happens, the cow may lie down and in doing so the action causes the womb to slip into its place, when delivery is easily effected. In any case, if when the cow is lying she is pushed from one side to the other the womb will go back into position Again the hand should be inserted into the passage to ensure that the animal is being moved in the right direction.

Constriction of the Os Uteri

In this case, as in the one just described, all the signs of calving will be in evidence, but not even the contents of the membrane will appear. On introducing the hand it will be found that the mouth of the womb is closed, or practically so. In this instance the animal should be given a dose of physic made up of 1 lb. Epsom salts to which has been added 2 oz. chloral hydrate or 2 oz. tincture of opium. She should then be put in a quiet place and left alone, when, in the course of twelve to twenty hours, it will be found that the mouth of the womb relaxes and the calf comes away naturally. In a small proportion of cases of this kind it will be found that the mouth of the womb has undergone structural changes and become hardened, which means that there have been structural changes and the parts have become hardened by the addition of fibrous tissue. Such cases will not relax under treatment, and the knife has to be applied and the mouth of the womb cut open before delivery can be effected. Such cases frequently prove fatal.

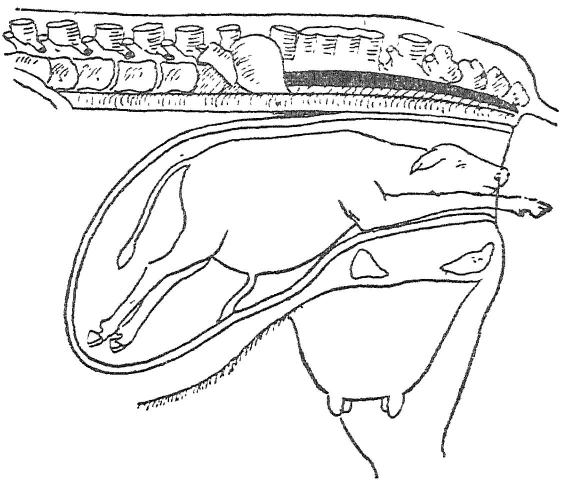


FIG. 7. DROPSY OF ABDOMEN OF FOETUS.

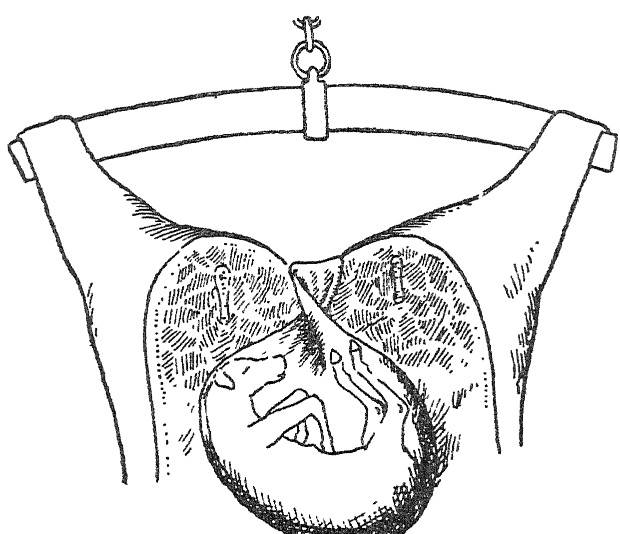


FIG. 8. TORSION OF VAGINA. [After H. Thompson

Inertia of the Uterus.

The cow although showing signs of calving may make no real effort to do so. She may be seen walking up and down the paddock all day long, switching her tail and frequently lying down without any severe labour pains being in evidence. This is due to want of tone in the muscular coat of the womb. When the hand and arm are introduced the parts will be found intensely relaxed and everything in readiness to come away In this case the feet should be roped and steady traction applied, and meanwhile the hand of the operator should be kept on the crown of the calf's head so as to direct its entrance into the passage, after which the hand can be removed and delivery takes place. In such cases it is absolutely necessary that the fœtus be removed, otherwise the pains will cease, and if the fluids have escaped a simple calving case is turned into a most difficult one.

HOT-WATER TREATMENT OF SEED BARLEY.

FIELD EXPERIMENTS IN CANTERBURY, SEASON 1928–29.

C H. HEWLETT, Canterbury (N Z) Seed Co , Ltd., Christchurch.

IT was indicated in the last report on this work (published in the *Journal* for September, 1928) that an attempt would be made during the 1928–29 season to eliminate the smuts from the bulk of the malting-barleys of Canterbury. With this object in view, both the Canterbury Seed Co. and New Zealand Breweries, Ltd , used for seed purposes in their contracts seed " once removed from treatment," and with the advice and assistance of Mr. J C. Neill, Field Mycologist, Department of Agriculture, the plan was put into operation. Thus about 70 per cent. of the malting-barley crops of Canterbury were produced from seed once removed from treatment.

The following matter presents the practical results of the hot-water treatment of seed barley on 4,331 acres of malting-barley in the Canterbury District, north of the Rakaia River, for last season.

The method of treatment employed was in essentials that of the 1927–28 season—a presoak of five hours in water at 60° to 70° F., followed by a dip of five minutes in water held at 127° F.

Samples were taken for germination, and tests made at the Official Seed-testing Station, Palmerston North, gave the results shown in Table 1. Results for the previous three seasons were published in the *Journal* for June, 1927, and September, 1928.

The crops made splendid early progress in the 1928–29 season, and at the end of November promised a record yield. but about 9 in. of rain fell between 1st December and 7th January, which encouraged rust and completely laid the bulk of the crops, which on the heavy lands were of such luxuriant growth as to be unable to stand up to such an amount of moisture and suffered much more damage than those on the lighter lands. Under these circumstances, the better

Table 1.—Germination Tests.

Variety	—	Days										Total.
		1	2.	3	4.	5	6	7.	8.	9.	10.	
		%	%	%	%	%	%	%	%	%	%	%
Chevallier	Control	..	72	99	100	..	.	..	..	..	.	100
,,	Treated	.	13	60	88	92	93		95	.	.	95
Plumage	Control		33	98	100	..	..	..	..		.	100
,,	Treated		15	58	88	*	95	96	.		.	96
Archer Spratt	Control		65	98	99	100	.	..	..		.	100
,,	Treated		13	89	92	94	95	97	..	.	.	97
Goldthorpe Spratt	Control		16	*	99	100	..	..	..	.	.	100
,,	Treated		9	*	95	97	100	..	..	.	.	100
Plumage Archer	Control	..	32	100	..	..	..	.	.	..	..	100
,,	Treated	.	7	49	80	*	89	90	92	94	..	94

* Sunday—Laboratory closed.

the land the worse the crop, both in quantity and quality. Just before the crops started to ripen continuous hot weather was experienced, and the barley ripened much too quickly. Owing to these conditions the yields were much lighter than they would have been otherwise, while the quality of the grain, especially that grown on the heavier lands, suffered severely. However, despite such severe handicaps the yields were good.

As already indicated, acting on the preceding two years' experience of treated seed, the Canterbury Seed Co. and New Zealand Breweries arranged in their barley-growing contracts for the provision of treated seed, consequently 70 per cent. of the Canterbury growers, and nearly all those north of the Rakaia River, used seed once removed from treatment, leaving only an area of about 30 per cent. to be grown from untreated seed, and that mostly south of the Rakaia. Very little untreated seed having been used in the districts where the treated seed was used, comparison is not feasible.

By using the Government Statistician's figures for the whole of Canterbury, however, a certain amount of information can be gained, and the following tables present a condensed summary of the actual results from both treated and untreated seed. Under the heading of "treated" is included both "direct from treatment" and "once removed from treatment." The figures used in this article have been obtained from the product of 4,331 acres of barley grown on contract and sown with treated seed.

In any comparison it is necessary to note that the direct-treatment barley had the advantage of being grown on very good land, probably above the average of that on which the once-removed was grown.

All the seed direct from treatment was grown on the Canterbury Seed Co.'s farms. The drills used were cleaned out and disinfected with a strong solution of formalin; the reapers and binders were treated in the same manner before reaping operations commenced; and the threshing machines were also similarly treated before threshing. This was done with a view to prevent reinfection of the product, so as to enable the seed saved to be used as once removed for sowing

a large area for the following season. The grain-cleaning machines used to clean the once-removed product were also cleaned down and disinfected with formalin.

Table 2.—Yield of Seed Direct from Treatment and Once-removed from Treatment (Mill Firsts only).

Variety.	Direct Treatment.			Once-removed.			Total.		
	Number of Farms.	Acreage.	Yield per Acre.	Number of Farms.	Acreage.	Yield per Acre.	Number of Farms.	Acreage.	Yield per Acre.
			Bushels.			Bushels.			Bushels.
Chevallier ..	2	45	65·8	31	526	52·24	33	571	53·31
Plumage ..	1	9	60·8	6	83	52·02	7	92	53·09
Archer Spratt ..	2	63	59·5	139	2,862	53·05	141	2,925	54·10
Goldthorpe Spratt	1	10	40·8	14	271	41·31	15	281	41·59
Plumage Archer	1	23	61·2	28	439	56·91	29	462	57·13
Total ..	7	150	60·9	218	4,181	53·23	225	4,331	53·50

Upon an inspection of the crops by Mr. Neill in January, 1929, and again later, it was found that all the product of the seed direct from treatment was absolutely free from smut.

Some of the product of the seed direct from treatment, grown in the 1927–28 season on farms other than the Canterbury Seed Co.'s, as mentioned in the September, 1928, issue of the *Journal*, was threshed through an ordinary mill, and although the mill was cleaned down and disinfected its structure was such that it was impossible to effectively deal with it, and a slight trace of smut was found in a few isolated instances in the product of the once-removed seed which had been threshed through this class of machine. In no case, however, was smut found in the product of treated seed threshed by a mill which had been properly and efficiently cleaned down and disinfected.

The product shown in Table 2 was graded as follows:—

Table 3.—Grading of Product (Mill Firsts only).

[D.T. signifies direct-treated seed; I.R. signifies once-removed seed.]

Grade.	Chevallier.		Plumage.		Archer Spratt.		Goldthorpe Spratt.		Plumage Archer.		Total.		Grand Total.
	D.T.	I.R.	D.T.	I.R.	D.T.	I.R.	D.T.	I.R.	D.T.	I.R.	D.T.	I.R.	D.T. & I.R.
	%	%	%	%	%	%	%	%	%	%	%	%	%
No. 1 Grade	100	44·97	..	42·12	..	49·70	..	56·59	..	33·85	32·44	47·53	46·94
No. 2 Grade	..	29·14	100	32·47	35·9	38·22	100	25·90	100	46·63	41·24	37·31	37·47
Undergrade	..	25·89	..	25·41	64·1	12·08	..	17·51	..	19·52	26·32	15·16	15·59
Total ..	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 4.—Comparison of Yields of Canterbury Treated Seed with Government Statistician's Figures

—	District	Area	Yield per Acre
			Bushels.
Direct-treated and once-removed seed	North Canterbury	4,331 acres ..	53·5 (mill firsts only)
Statistician's figures	All Canterbury ..	9,561 acres (including 4,331 acres of treated)	45·87 (including mill seconds)

Table 5.—Comparison of Government Statistician's Figures for Yields of last Four Years with Yields from Treated Seed

—	1926	1927	1928	1929.	Threshing
	Bushels.	Bushels	Bushels.	Bushels	
Canterbury (treated only)* ..	..	61·85	60·77	53·50	Mill firsts only.
Canterbury (including treated)	37·51	49·73	48·97	45·87	Including mill seconds
Marlborough	32·22	35·92	36·57	31·18	Including mill seconds
Otago	40·08	34·42	32·31	36·23	Including mill seconds

* Seed Co.'s figures.

The year 1926 being the first in which these experiments were conducted, only a small area was sown with seed direct from treatment, and none with once removed, as none was available. After the 1926 harvest the figures were collected for the product of seed direct from treatment and once removed from treatment from the following areas: Harvest 1927, 560 acres; harvest 1928, 1,046 acres; harvest 1929, 4,331 acres. The figures for the later periods, having been compiled from a larger acreage, possess an added value.

Even making allowance for good seasons, the foregoing evidence points to the fact that the greater yield of the Canterbury crops must have been influenced by the attention given to pure strains of smut-free seed during the past few years. Both yield and quality of the crop have been markedly improved, and the growing of this cereal in Canterbury has now been placed on a more reliable and profitable basis. It is significant, however, that the greatest care has to be exercised in order to keep the seed from reinfection, and, as already mentioned (not only in this article but in that published in the June, 1927, issue), reinfection follows from the use of machines inefficiently cleaned or disinfected.

The whole programme of experiments was carried out with the valued assistance and advice of Mr. J. C. Neill, supported by other officers of the Department in various ways. Acknowledgment is also due to Mr. H. Neave, the Seed Co.'s manager at Leeston, who superintended the sowing and harvesting operations, and to New Zealand Breweries for their co-operation.

Experiments have also been carried out on somewhat similar lines with about 1,000 acres of wheat and oats, but this work is not yet far enough advanced for publication of results. Experiments are proceeding during the current season with barley, wheat, and oats as a result of which it is expected some valuable information will be available.

ORGANISM PRODUCING BURNT FLAVOUR IN CREAM OR BUTTER.

STREPTOCOCCUS ISOLATED AT WALLACEVILLE LABORATORY.

G. F. V. MORGAN, N.D.A., N.D.D., Dairy Bacteriologist, Wallaceville Laboratory.

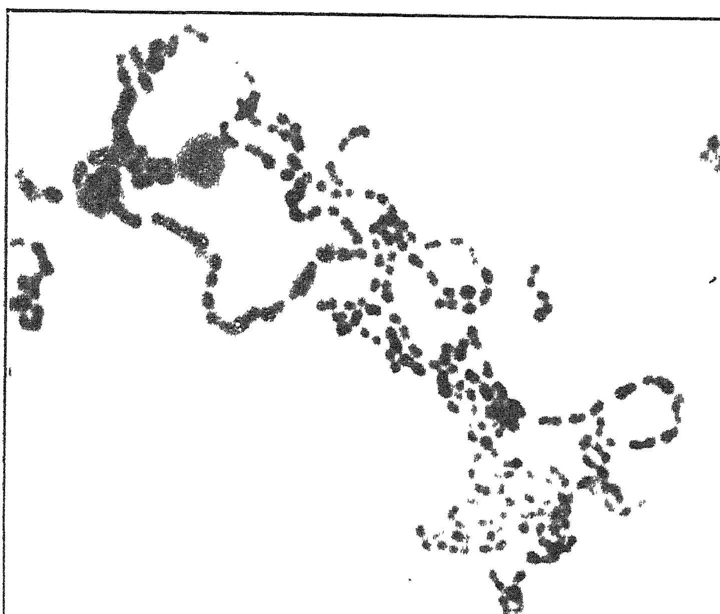
DURING an investigation at Wallaceville of the types of bacteria that resist pasteurization in dairy-factory plants a number of washings from these plants were examined and a bacteriological survey made of the types present in the plant directly after pasteurization was completed. From several of these washings a type of streptococcus was isolated which appeared to be present in certain plants in considerable numbers, forming as high as 30 per cent. of the streptococcus type of colony present in a 1 : 10,000 dilution. The organism, when cultured in milk and lactose broth, appeared to be similar to *Streptococcus lactis*, apart from the fact that it seemed slightly larger than the usual strains of lactic streptococci found present in milk, and seemed to develop a more marked chain formation, particularly in the early stages of growth.

The writer has noticed when working with raw milks and samples of factory starters received at this Laboratory that the usual virile lactic streptococci commonly found present have a tendency to grow in pairs or short chains of four to five organisms until the maximum acidity has been reached. After a curd is formed and the milk or starter becomes overacid, long chain formation becomes much more marked and seems to increase until the organisms lose their vitality and becomes so attenuated that they lose their power of rapid acid production in subsequent transfers.

This loss of power did not appear to be the case with the streptococcus isolated from pasteurization plants, which developed marked chain formation from its early stages of growth both in milks and broth cultures, and showed no lack of ability or slowness in acidity production. A pure culture of this streptococcus was procured by removing a probable colony from one of the original shake cultures of washing-water, transferring it to 10 c.c. of lactose broth, and adding the whole after culture at twenty-four hours to 1 litre of milk (particular care being taken to flame the neck of the test tube and flask). In this way a starter was obtained from a pure culture of the streptococcus and was examined after twenty-four hours' incubation at 68° F. The curd produced was normal in every way, but the aroma and flavour were totally different from that produced by *S. lactis*, having a very decided burnt or caramel flavour. This starter was subcultured regularly for two weeks, and maintained the burnt flavour without change or abatement. (It may be mentioned here that after the first appearance of a burnt flavour the milk used for cultivation was sterilized for three successive days at a little below boiling-point, so that any chance of charring the milk before cultivation was avoided.)

A pure culture of *S. lactis* (commercial starter organism) was obtained from Mr. H. R. Whitehead, of the Dairy Research Institute,

and the two types of streptococci were cultivated under identical conditions for two weeks, the flavours of both types remaining identical and distinct. In addition to this, the cultures of *S. lactis* and the flavour-producing streptococcus were grown in duplicate in 500 c.c. quantities of milk, and incubated for twenty-four hours at 68° and 98½° F. The results were as follows: At 68° over a period of one week *S. lactis* produced a normal starter curd with a clean acid flavour and no indication of a slowing of acidity-production. At 98½° the first culture appeared normal in texture and flavour. As the week progressed the starter took considerably longer to incubate, producing a sharp acid flavour, and soon showed signs of wheying off after coagulation and shaking; at the end of the week it was practically



PHOTOMICROGRAPH OF THE FLAVOUR-PRODUCING STREPTOCOCCUS

dead. The flavour-producing streptococcus at 68° produced acidity slowly, with burnt flavour pronounced, but not as pronounced as that produced at 98½°; the curd was normal. At 98½° the rate of acidity production increased, and the burnt smell and taste became very pronounced. There was no sign of decreased acidity-production or attenuation at the end of a week.

During the time the experiments on direct cultures from milk to milk were being carried out several cultures were taken of the flavour-producing streptococcus and passed through casein agar and lactose broth into milk again, when the same burnt flavour was produced. As this particular strain was originally so predominant among the streptococci found present in pasteurization plants it would appear to have

considerably greater heat-resisting powers than the ordinary lactic streptococci. This is also borne out by its ability to maintain its virility at high incubation temperatures. Several flasks of starter of this strain were flash-pasteurized in the Laboratory to 165° F., and cultured at 98½° on casein agar plates from dilutions of 1/1,000,000 and over of the starter The resulting cultures showed a large surface growth of streptococcal colonies, though not as large a growth as would have appeared if all the organisms had survived. When these colonies were removed and passed via broth into milk again the burnt smell and flavour typical of this organism was further intensified.

SIGNIFICANCE TO THE BUTTERMAKER.

After these experimental results had been obtained with starter it was considered important to determine the significance of this type of streptococcus to the buttermaker, more particularly with regard to the "peanut flavour" common in Auckland District To this end 1 litre of cream was ripened with the flavour-producing streptococcus, and a control with *S. lactis*. In the first case the cream developed the typical burnt flavour, which was carried over into the butter and seemed to be accentuated rather than diminished by salting. (On keeping in cold store this flavour held but did not increase)

A more extensive experiment was then carried out in which 12 litres of fresh cream of low bacterial count were measured out into twelve sterile 2-litre flasks; six of these flasks were sterilized and the other six left untreated. A series of these sterilized flasks were inoculated with the flavour-producing streptococcus and three with *S lactis*, and were allowed to ripen to acidities of 0·15, 0·25, and 0·4. These creams were then churned in the flasks in which they were ripened, and worked under practically sterile conditions. All the butters made from cream ripened with the flavour-producing streptococcus had the same markedly scorched flavour to about an equal degree, in spite of the variation of acidity. The remaining six flasks were inoculated with an equal quantity of the two starters in the same manner as the first series, only the cream was at no time heated or sterilized, and the normal bacterial flora was allowed to develop as the ripening process continued. The same acidities were developed as in the first series, and gave the following results: The flavour-producing streptococcus developed a marked flavour at 0·15 and at 0·25 acidity, but at 0·4 acidity a rancidity due to the presence of an excess of coliform organisms was by far the most predominant flavour.

In the three flasks ripened by *S lactis* and sterilized, and in the three flasks of raw cream ripened with the same starter, the flavours were clean and palatable, except in the cases of raw cream ripened to 0·25 and 0·4 acidity, the former having an uncertain flavour, and butter from the latter being decidedly objectionable

A broth culture of this streptococcus was forwarded to Mr. Whitehead, who tested in starter form and ultimately in cream and butter. He reported as follows: "When 2 per cent. of culture was added to the cream the butter had a most marked and objectionable caramel flavour (the cream also had this flavour before churning). When 0·1 per cent. of culture was added to the cream no flavour was detected in the butter one day old."

This particular strain of lactic streptococcus may be of considerable importance to the buttermaker, as it has been frequently noticed at this Laboratory in samples of washing-water from pasteurization plants, both in cheese and butter factories. The possibility exists that in a number of cases scorched flavours in butter are due to streptococci of this type, and not to pasteurization at too high a temperature as is usually supposed.

Classification of the Organism

Considerable study has been made in the past of various strains of lactic streptococci, among which *Streptococcus thermophilus* (Orla Jensen) has been isolated. The streptococcus isolated at Wallaceville compares fairly nearly to this strain, but differs in the following characteristics: Though a heat-resisting streptococcus it has not the same ability to resist high temperatures as *S thermophilus*; it has not the same characteristics in reduction of litmus milk, and over a series of sugar reactions has never shown an ability to ferment sucrose, though the other sugar reactions typical of *S. thermophilus* were identical over a series of tests for one week. This was surprising in so far as the sugar reactions of the streptococcus group are frequently very irregular.

The sugar reactions of *S. thermophilus*, the streptococcus isolated at Wallaceville, and *S lactis* respectively are indicated in the following table.—

——	*S thermophilus*	Flavour-producing Streptococcus			*S. lactis.*
		First Day.	Second Day.	Third Day.	
Dextrose	+	—	—	+	—
Laevulose	+	+	+	+	—
Mannose	+	—	—	+	+
Galactose	+	—	+	+	—
Sucrose	+	—	—	—	*
Lactose	+	—	+	—	+
Maltose .. .	+	+	+	+	—
Salicine . ..	..	..	..	..	+

* Doubtful

The series of sugars shown above gave constant reactions with the flavour-producing streptococcus, showing a distinct similarity to those sugar reactions of *S. thermophilus*, apart from its inability to ferment sucrose. It is considered that acidity-production is uncertain in maltose with cultures of *S. thermophilus*. In the case of the streptococcus isolated at Wallaceville maltose was always readily fermented. Its action on litmus milk was identical with that of *S. lactis*, and did not show the partial reduction of litmus typical of *S. thermophilus*.

Conclusions.

The organism isolated at Wallaceville appears to be a distinct strain of *S. lactis*, having an increased ability to resist heat and a marked ability to create scorched flavours in cream, milk, or butter. This organism is not identical with any of the flavour-producing types

of streptococci previously isolated, but appears similar in most of its sugar reactions to *S. thermophilus* (Orla Jensen) as classified in Bergey's "Manual of Determinative Bacteriology."

The organism is probably present to some extent in a number of milk and cream samples, together with the ordinary strains of lactic streptococci. If it is present in the raw milk to any extent it is possible that pasteurization, by destroying the less heat-resisting streptococci, may thereby increase the proportion of this flavour-producing type. This possibility is of particular importance in starter milks, particularly in butter-factories.

The possibility exists that this type of lactic streptococci may be responsible for a number of samples of butter having a scorched flavour that had hitherto been attributed to overpasteurization of cream. In this connection it is interesting to mention that when cream has been autoclaved in this Laboratory for the purpose of obtaining a quick and thorough sterilization, and therefore taken to a much higher temperature than could be obtained in the factory, no definite charred flavour has resulted in the butter made from the cream and ripened with *S. lactis*.

STRATFORD DEMONSTRATION FARM.

NOTES ON OPERATIONS IN 1928–29 SEASON.

J. M. SMITH, Chairman of the Farm Committee.

THE weather conditions experienced in the Stratford district during the year ended 31st July, 1929, were favourable for farming, particularly as regards pastures, although a short dry spell during the early autumn necessitated a start being made on the winter reserve of fodder at the Demonstration Farm.

At the close of the preceding year the last of the clearing, stumping, and breaking-in had been completed on the farm; so that during the season under review the work carried out was chiefly in connection with pasture management, and cropping was reduced practically to a minimum. The farm is now in line with the majority of dairy-farms in the coastal and central districts of Taranaki, in that breaking-in has been completed and pasture management is now receiving major attention.

Whether supplementary fodder cropping can be entirely dispensed with under the existing conditions is a matter of conjecture, but there is no doubt that by proper pasture management—in the direction of bringing the feed away earlier in the spring, prolonging the growth further into the winter, and increasing the growth during the flush period—the herds can be well treated with a smaller acreage of supplementary fodder crops than has been the case in the past. The more thorough cultivation and attention to these crops has no doubt meant in recent years that a bigger tonnage has been taken off a smaller area, and this in no small degree has resulted in a smaller area being under the plough; but the biggest factor in the reduction of the cropping area has certainly been our increased pasture-production,

following better management in the way of top-dressing, grazing, and harrowing. It is the intention of the farm committee to see just how far we can go towards eliminating cropping without in any way reducing our butterfat-production or making that production economically unsound.

During the season, of the 142 acres comprising the farm, only 9 acres were under the plough, and on this area none of the crops grown were for autumn feed. An area of 3 acres was in mangels, 1 acre in carrots, and 5 acres in autumn-sown oats for early spring feed. Hay was conserved from 14½ acres, and ensilage made from 25 acres. Of this 25 acres it was originally intended to save 8 acres for hay, but owing to unfavourable harvesting weather during January it was decided at the last minute to make this area into ensilage, and although it was recognized that the crop had gone past its best stage for ensilage-making it was felt that a second-class ensilage was preferable to an inferior bleached hay.

PASTURES.

An abnormal growth brought about by the very favourable growing-conditions experienced at Stratford, in common with other districts, during the late spring and early summer, and it was found necessary to run the mower over the whole of the pastures. This "topped" material was saved as hay, as there was a considerable amount of it, and the pastures were thus kept controlled and in a young growing condition.

Realizing the losses that occur due to faulty seed-mixtures in the laying-down of permanent pastures, the committee is working in close co-operation with the Agrostologist of the Department of Agriculture (Mr. E. Bruce Levy) in connection with the sowing of truly permanent and suitable grasses. A series of pasture trials was established in the spring of 1928, and some valuable data have already been obtained.

The standard top-dressing trials commenced previously have been continued, with interesting results. Most of the new trials have been on the use of nitrogenous manures. To test the value of sulphate of ammonia, as a manure considered of great value in bringing away early feed and prolonging autumn growth, two paddocks were selected which were identical in every respect. One of these paddocks had at different periods, in addition to the ordinary phosphatic dressings, four separate dressings of sulphate of ammonia at the rate of 1 cwt. per acre; the second paddock had only the phosphate. The grazing figures of the two paddocks were kept, as were also the milk returns, and results will be dealt with in conjunction with a number of similar experiments conducted by the Department of Agriculture.

A further trial with some of the concentrated manures now on the market was commenced during the year. A 10-acre paddock was divided into three equal parts, one being treated with superphosphate, one with Leunaphos (containing phosphate and nitrogen), and the other third with Nitrophoska (containing phosphate, potash, and nitrogen). Grazing data from each of these paddocks are being kept, and it is hoped that some valuable information will become available in due course.

Feeding of Concentrates to Dairy Cows.

With the object of obtaining information on the economic value of feeding to dairy cows small quantities of concentrates, in addition to the ordinary farm fodders (grass, roots, &c.), a test was commenced in the spring of 1927. The whole farm herd was fed with 2 lb. per day of a mixture of one-third each of crushed oats, bran, and linseed nuts, from the middle of August to the 10th September, and the milk weighed and tested for butterfat three times during the period.

The herd consisted of fifty-six cows, and on 10th September forty of what were considered the most suitable animals, giving due consideration to age, date of calving, and general condition, were selected and divided into two groups of twenty each, the same points being again taken into consideration, plus the milk weights and butterfat tests. When these groups were brought together it was found that Group A had given 324·23 lb. butterfat and Group B 322·82 lb. for the ten-day period ending 10th September. The general test was started as from 10th September; Group A (twenty cows) continued to receive 2 lb. of concentrates per day, and Group B (also twenty cows) no concentrates. The test was continued on these lines until 31st March, 1928, and the following summary gives the results:—

Table 1.

Month	Feeding Group A.		Non-feeding Group B		Increase of Group A over Group B.
	Butterfat for 10-day Periods	Total for Month.	Butterfat for 10-day Periods	Total for Month.	
	lb.	lb.	lb.	lb.	lb.
September	324·23		322 82		
	328·99		323·71		
	345·67	998·89	332·42	977·95	20·94
October	349·30		331·40		
	366·28		336·49		
	345·37	1,060·95	328·25	996·14	64·81
November	341·08		332·56		
	352·56		325·49		
	326·72	1,020·36	299·76	957·81	62·55
December	327·75		281 01		
	315·63		270·84		
	326·66	970·04	297·95	849·80	120·24
January	304·07		274·28		
	302·74		262·09		
	274·65	881·46	239·55	775·93	105·53
February	246·84		202·47		
	221·21		185 74		
	227·54	695·59	189·47	577·68	117·91
March	229·21		198·82		
	245·58		213·46		
	221·38	696·17	193·68	605·96	90·21
Total for seven months	..	6,323·46	..	5,741·27	582·19

The results may be summarized as follows :—

Feeding group	..	6,323·46 lb butterfat.		
Non-feeding group	..	5,741·27 lb		
Difference in favour of feeding group	..	582·19 lb		
				£ s. d.
Cost of concentrates, at 3d. per cow per day, for 210 days ..		..		52 10 0
582 lb. butterfat at 1s 6d per pound		..		43 13 3
		Loss ..		£8 16 9
Average for feeding group, 236 days in milk	..	335·56 lb butterfat.		
Average for non-feeding group, 237·5 days	..	317·36 lb		
Average increase of feeding group ..	..	18·30 lb		

Particulars of the loss on concentrates are shown in the following table :—

Table 2.

Month	Cost of Concentrates	Value of Extra Butterfat.	Profit or Loss
	£ s d	£ s d.	£ s d
September	7 10 0	1 11 6	5 18 6 loss
October .. .	7 10 0	4 17 6	2 12 6 ,,
November . ..	7 10 0	4 13 9	2 16 6 ,,
December . ..	7 10 0	9 0 0	1 10 0 profit.
January . ..	7 10 0	7 17 6	0 7 6 ,,
February .. .	7 10 0	8 17 0	1 7 0 ,,
March .. .	7 10 0	6 15 0	0 15 0 loss.

These figures show a loss from concentrate feeding for the three best production months—September, October, and November ; a slight gain for December, January, and February, when the monthly totals of butterfat are going down ; and a loss of 15s. for March, which month showed a slight increase over February. These results are for one season only, but to a great extent they bear out the data obtained in a similar test at the Waimate West Demonstration Farm in the preceding year.

The trial was repeated at Stratford in 1928–29, with the addition of a third group of cows. The whole herd was again put under test, and two main groups of sixteen cows in each and a third group of twelve cows were selected, the groups being kept the same as in the previous seasons as far as possible. The groups were made up of sound cows, the animals which were being carried through and those which had "slipped" being discarded. This accounts for the groups being smaller numerically than they were in the previous season. Calving-dates were given due consideration in the selection of the groups.

The butterfat-production per cow in the first period of ten days was as follows : Group A, 12·33 lb. ; Group B, 12·34 lb. ; Group C, 12·13 lb. The test commenced on 1st September. Group A was fed with concentrates at the rate of 2 lb. per day, made up of a mixture of one-third each crushed oats, bran, and linseed nuts. Group B received no concentrates at all, and Group C was fed in the same way as Group A till 21st October, or, roughly speaking, for the first seven

weeks of the season. Apart from the concentrate feeding, all groups had exactly the same treatment as regards paddocks supplementary feeding on hay and roots, &c. The trial was continued until 30th April, and the following summary gives the results of the two main groups :—

Table 3.

Month	Feeding Group A.		Non-feeding Group B.		Increase or Decrease of Group A.
	Butterfat for 10-day Period.	Total for Month.	Butterfat for 10-day Period.	Total for Month.	
	lb.	lb.	lb.	lb.	
September ..	219·48 237·01 236·52	693·01	240·55 238·92 241·18	720·65	Decrease 27·64 lb.
October ..	257·24 258·19 269·38	784·81	284·34 266·53 259·72	810·59	Decrease 25·78 lb.
November ..	252·14 247·39 244·38	743·91	251·14 252·78 241·93	745·85	Decrease 1·94 lb.
December ..	225·87 223·33 219·06	668·26	244·32 229·03 216·67	670·02	Decrease 1·76 lb.
January ..	236·05 230·19 201·68	673·92	219·03 216·00 202·38	637·41	Increase 36·51 lb.
February ..	217·71 205·77 191·86	615·34	221·49 199·58 182·69	603·76	Increase 11·58 lb.
March ..	165·25 171·49 159·01	495·75	164·76 174·98 169·64	509·38	Decrease 13·63 lb.
April	140·04 148·37 134·41	422·82	155·71 150·78 134·44	440·93	Decrease 18·11 lb.
Totals, &c. ..	..	5,097·82	..	5,138·59	Net dec., 40·77 lb.

Summarized results are shown in the following figures :—

Feeding group A	5,097·82 lb. butterfat.
Non-feeding group B	5,138·59 lb.
Difference in favour of B	40·77 lb.

	£	s.	d.
Cost of concentrates, 16 cows, 242 days, at 3⅓d. per day	53	15	6
Plus loss of 40·77 lb. butterfat (decrease of fed group) at 1s. 6d. per pound	3	1	2
	£56	16	8

It is not suggested that this loss of £3 1s. 2d. worth of butterfat is the direct result of the concentrate feeding, but the main point is that there is no significant difference in favour of the fed group, let alone a difference that would cover the actual cost of the feeding.

On account of Group C being composed of only twelve cows, as against sixteen in Groups A and B, the comparison in this case is made per cow. The butterfat-production per cow in each of the three groups is as follows: Group A, 318·61 lb.; Group B, 321·16 lb.; Group C, 332·12 lb. The value of the butterfat produced per cow in the different groups is: Group A (fed whole season), £23 17s. 10d.; Group B (control), £24 1s. 8d.; Group C (fed seven weeks), £24 18s. 2d. In other words, the group fed for the whole season showed a decrease of 3s. 10d. worth of butterfat per cow, while the group fed for seven weeks showed an increase of 16s. 6d. worth. In addition, the cost of feeding per cow of Group A was £3 7s. 2d., making a loss of £3 11s. on this group; while the cost of feeding Group C was 14s. 2d. per cow, showing a profit of 2s. 4d. per cow in increased butterfat over cost of feeding.

As regards the results, the difference in the butterfat return per cow for any one group is not significant enough to show that any profit can be made from concentrate feeding, and indications over the two seasons' work point rather in the opposite direction. The results only strengthen the supposition that where cows come into profit in good condition, and are provided with *sufficient* good pasture and roots, the feeding of small quantities of concentrates is not directly profitable.

Another point worthy of consideration where concentrate feeding is being carried out is in connection with dairy-stock diseases, but as far as this farm is concerned the 1928–29 season's trial gave no indication that the feeding had any direct beneficial results, as an equal number of cows in each of the preceding season's groups calved prematurely and one in each group failed to hold to service at the beginning of that season. While this cannot be taken as conclusive by any means, it is an interesting observation.

GENERAL.

During the season under review the herd consisted of fifty-four cows, and the butterfat average, taken from factory returns, was 308 lb. per cow. Production was lower than during the preceding season, mainly owing to a smaller herd going through the shed on account of heavy sales of stock during the previous dry autumn, and partly due to the failure to come to profit of a few of the cows.

Two general field-days were held during the year, and these were well attended; in addition several district field-days took place. The farming public are continuing to take a keen interest in the farm and the various trials and experiments.

Alleged Honey-poisoning.—In connection with the alleged honey-poisoning cases which occurred at Morrinsville in March, 1928, arrangements were made by the Horticulture Division under which a test hive was placed in the locality. Honey taken from this hive at intervals during last season was submitted to examination at the Wallaceville Laboratory, but all the tests proved negative

BUTTERFAT LOSSES IN BUTTERMILK.

INVESTIGATION IN AUCKLAND PROVINCE.

W. H. UDY, B.Sc., A.I.C., Dairy Research Laboratory, Hamilton, in the *New Zealand Journal of Science and Technology*.

INTRODUCTION.

IN 1926 a report was drawn up by the writer on the butterfat losses in buttermilk over the 1924–25 season at a number of South Auckland dairy-factories, and though the methods of investigation were not wholly satisfactory it was indicated that very serious losses were occurring. The system adopted in order to check the amount of the loss at each factory was to obtain ten-day-period composite samples of buttermilk at a central laboratory for each of the butter-factories, and these were analysed for fat by a modified Rose Gottlieb method, while the total solids was determined and the percentage of fat calculated on a buttermilk containing 8·8 solids-not-fat.

It has to be remembered that after a cream comes into a butter-factory in New Zealand a considerable amount of water finds its way into the skim-milk portion by the time this latter appears as buttermilk, and it is thus necessary in any system for determining the fat losses to either measure the quantity of buttermilk produced and test same for fat, or else, by working on the solids-not-fat figure and estimating the amount of added water, to make allowance for the added water. Any test of fat alone is quite meaningless unless account is taken of this added water. To measure the amount of buttermilk daily is a somewhat difficult proposition, and it was therefore thought better to proceed on the second line of action—namely, to determine the solids-not-fat and to calculate from this the added water.

Following on the first season's work an attempt was made to institute a system whereby the work might be done at each factory and the daily losses obtained for the guidance of the factory-manager. In this work a daily proportioned composite sample of buttermilk was drawn and tested in the factory test-room. The fat was done by the butyl-alcohol modification of the Babcock test, details of which are given later in this report. The total solids were done by weighing 10 grammes of buttermilk into an aluminium beaker as used for butter-moisture determination, and the drying was done rapidly in a similar manner as is used for moisture determinations of butter. In experienced hands this method of determining total solids in buttermilk will give results with a maximum error of under 0·2 per cent., which was considered sufficiently accurate for the purpose.

Having determined the total solids and the fat in the buttermilk, the added water was determined from the following formula :—

$$\text{Added water} = [8{\cdot}8 - (TS - F)]\frac{100}{8{\cdot}8}$$

where TS represents the total solids determined and F the fat test of the buttermilk. In this formula 8·8 is taken as the normal amount of solids-not-fat in buttermilk free from water added in the factory. The figure actually will vary a few points, but this will have but little effect on the loss figure, and was considered suitable for our purposes.

The fat in buttermilk free from added water was calculated from the following formula :—

$$F\ (\text{w.f.}) = \left(\frac{8 \cdot 8}{TS - F}\right) F$$

where F (w.f.) = fat in buttermilk free from added water ;
TS = total solids in buttermilk ;
F = fat test of buttermilk.

The losses of butterfat are best expressed as a percentage of the butterfat handled. If the quantity of buttermilk obtained were measured, this with the fat test would enable the total fat lost to be determined and expressed as a percentage of the fat received. Where the quantity of buttermilk is not measured, the quantity of buttermilk free from added water can be calculated from the weight of cream and the average test by the following formula :—

$$\text{Bm.} = W \left(\frac{100 - 1 \cdot 12T}{100}\right)$$

where Bm. = buttermilk free from added water ;
W = weight of cream ;
T = fat test of cream.

This formula is based on the fact that analyses of butter indicate that approximately 10 per cent. of its weight is buttermilk. From 100 lb. of cream, therefore, the quantity of buttermilk which goes to waste is 100 lb., less the fat and one-tenth of the weight of butter. Butter equals 1·2T

From this calculated weight of buttermilk and its test the total fat lost is estimated, and expressed as a percentage of fat received.

This system of checking butterfat losses was carried on over one season, but again figures were found to be somewhat unreliable, mainly due to the fact that the method of determining total solids was not satisfactory under factory test-room conditions, and errors greater than anticipated were encountered. The additional season's work, however, supplied further knowledge of the great losses of butterfat occurring

At the beginning of the 1928–29 season the present work was undertaken. It had for its objects—firstly, an investigation into the methods to be used for analysing and testing buttermilk for fat, and the institution of a system for making a daily check of the fat losses at the factory ; secondly, the actual losses occurring from day to day at fourteen different butter-factories operating throughout the Auckland Province were to be determined, using the butyl-alcohol modification of the Babcock test for testing for fat, and determining the solids-not-fat by the use of a Quevenne lactometer and the Richmond slide-rule.

The testing-work at the factories was checked by taking during each ten-day period one duplicate sample and forwarding to the central laboratory, where the fat was determined by the Werner Schmid method and the total solids determined gravimetrically. A series of cream-samples was also taken from each factory in order to obtain the solids-not-fat figure for use in determining the added water from the analytical figures on the buttermilk.

In addition to the above, the work was designed so that a study could be made of factors contributing to losses of fat in buttermilk.

Determining Losses occurring during 1928-29 Season at Different Factories.

The present report will be confined to the second portion of this work—namely, the determination of the losses actually occurring from day to day at fourteen different butter-factories in the Auckland Province.

Although the checking-up of losses at such a large number of factories at the one time is a difficult proposition, it was thought that a comparison of results obtained under so many different conditions would be an important means whereby causal factors might be traced. The actual establishment of the system whereby these losses might be efficiently determined was also considered an important function of the work.

Sampling of Buttermilk for Analyses.

The sampling of the buttermilk was carried out by the churn assistant with the use of a half-gallon dipper, which was marked off in five equal portions, representing approximately 1 lb. of buttermilk. With this dipper a proportional amount of buttermilk was drawn. The sample was taken half-way through the run-off, and was run into a covered can, which received samples from all churnings for the day. At the end of the day's churnings a well mixed sample was taken into the test-room, any butter granules were filtered off through buttercloth, and the sample then tested for fat and the lactometer reading and temperature taken.

Daily Testing of Buttermilk.

The fat test was carried out by the butyl-alcohol modification of the Babcock test. 6 in. test-bottles with 18-gramme bodies and necks, and graduated to 0·50 per cent. in 0·01 markings, were used. Details of the test are as follows:—

To the 0·5 per cent. Babcock bottle add as follows: 2 c.c. butyl alcohol, 9 c.c. milk, 9 c.c. sulphuric acid. Mix thoroughly, and whirl ten minutes in Babcock centrifuge. Add hot water to bottom of neck; whirl five minutes. Add hot water to neck; whirl three minutes. Read fat-column at 135–140° F., and double the reading (including the meniscus). It is best to use fairly strong acid—*i.e.*, not less than 1·83 specific gravity. The amount of acid can be varied to suit the strength. The right amount is being used when the curd is completely dissolved, and the fat-column is golden yellow or light amber in colour. If a dark streak or charring is showing at the bottom of the fat, too much or too strong acid is being used; if curd is showing, too weak or too little acid is being used. The speed of the machine should be raised above that used for ordinary testing by about 200 revolutions per minute. Care must be taken that test-bottles do not choke up at the neck, thus preventing the fat from rising into the column.

A blank determination should be tried occasionally—*i.e.*, put the test through using pure rain-water instead of buttermilk, and see if any fat is indicated. If any fat shows in the column on completion, something is wrong. The cleansing of the bottles and the purity of the acid and butyl alcohol must be investigated.

The fat test was entered daily on a report-sheet, together with the temperature and lactometer reading. Quevenne lactometers were used, reading from 0° to 40°. These were first tested against an N.P.L. standard. The lactometer reading was taken to an arbitrary but well-defined point approximating the top of the meniscus.

The weight of butter churned was also entered on the report-sheet. This was done because it is impossible to obtain figures showing weight of cream churned unless special equipment is provided for measuring up same. The butter figure serves sufficiently well for practical purposes in arriving at the weighted-average fat test in buttermilk over a period, since the average fat test of the cream varies but little from day to day.

The report-sheets were made up in ten-day periods—three periods commencing as near as possible on the 1st, 11th, and 21st of each month.

Calculation of the Percentage of Fat in Buttermilk free from added Water.

The great difficulty that exists in obtaining a system for checking up fat losses in buttermilk arises out of the fact that water is added to the cream in the factory either as rinse-water from cans and factory equipment or as break-water during the churning operation. This addition of water varies very considerably from one factory to another, and a simple fat test on a buttermilk is no indication as to what the losses are. In some cases no break-water whatever is added, while in others up to as much as 50 per cent. of the buttermilk has been found to be added water. The calculation of the fat losses is therefore dependent on a determination of the amount of this added water.

To do this, the total-solids figures were first worked up from the test-room figures by the use of the Richmond scale, using the formula $T = \cdot 25G + 1\cdot 2F + \cdot 14$. The solids-not-fat figure was then calculated on the buttermilk free from fat. Thus if x = percentage fat in buttermilk and y = solids-not-fat, corrected solids-not-fat $= \frac{100y}{100 - x}$. This was necessary for comparison with the basic figure, which must be determined from cream as solids-not-fat and expressed in the same manner.

In order to determine the amount of added water in previous seasons' work the writer had fixed 8·8 as the basic solids-not-fat in the fat-free portion of a cream coming into a factory, and used the formula

$$F\ (\text{w.f.}) = \left\{\frac{8\cdot 8}{TS - F}\right\} F$$

for calculating the fat in buttermilk free from added water. In this work, however, an attempt was made to arrive at something more accurate, and with this in view a large number of daily composite cream-samples were taken at the different factories. Home-separated cream when it comes into a factory has already had water added to it in varying amounts by the supplier, and the solids-not-fat content of home-separated cream is therefore somewhat less than is the case with factory-separated cream. A knowledge of the class of the supply together with the analyses of the one-day composite cream-samples enabled a basic figure to be fixed for each factory. These ranged

from 8·6 to 9·0 per cent., and must be looked upon as approximations only. In any day's cream-supply the figure might easily be as much as 0·3 out; nevertheless in the ten-day-period averages these errors will disappear and the loss figure will be a substantially correct indication of the position.

Table 1 sets out the ten-day-period average fat content of buttermilks calculated on the water-free basis. Fourteen factories are represented for the twenty-four periods of October to May inclusive. The ten-day weighted-average figure is calculated, as already mentioned, on the assumption that a daily butter-make is proportional to its buttermilk output.

TABLE 1.—PERCENTAGE BUTTERFAT IN BUTTERMILK FREE FROM ADDED WATER.

Period		Butter-factory.													
		No. 1	No. 2	No. 3	No. 4	No. 5	No 6	No 7	No. 8	No. 9	No. 10	No. 11	No 12	No 13	No. 14
1928															
Oct	1	..	..	0·82	..	0·83	1·01	..	..	0·77	..	0·90	..	1·11	1·00
	2	0·93	..	0·81	0·70	0·89	0·97	..	0·51	0·80	0·98	0·90	0·68	1·17	1·02
	3	0·87	0·91	0·88	0·87	0·86	0·96	..	0·53	0·72	1·00	0·95	0·63	1·05	1·10
Nov.	1	0·97	0·89	0·86	0·88	0·83	0·97	0·97	0·52	0·75	1·05	0·92	0·67	1·01	1·10
	2	0·99	0·95	0·89	0·72	0·79	0·87	0·89	0·56	0·64	0·77	..	0·65	0·95	1·14
	3	0·90	1·03	0·88	0·77	0·71	0·91	0·89	0·52	0·66	0·94	1·01	0·64	0·98	1·10
Dec.	1	0·85	1·04	0·89	0·76	0·77	0·97	0·95	0·52	0·66	0·88	0·97	0·68	1·01	1·10
	2	0·98	1·05	0·77	0·69	0·70	0·91	0·91	0·49	0·70	0·86	0·83	0·66	1·30	1·15
	3	0·87	1·09	0·81	0·83	0·74	0·96	0·94	0·48	0·76	0·92	0·96	0·69	1·16	1·16
1929															
Jan	1	0·93	1·13	0·93	0·84	0·74	0·89	0·98	0·53	0·74	1·00	0·89	0·75	1·17	1·11
	2	0·95	1·14	0·90	0·95	..	1·00	1·07	0·55	0·81	1·13	1·00	..	1·12	1·10
	3	0·74	0·98	0·82	0·90	0·75	1·04	1·06	0·55	0·70	1·06	1·00	0·71	1·20	1·15
Feb.	1	0·80	0·95	0·86	0·92	0·82	0·97	1·02	0·56	0·69	1·03	1·03	0·72	1·11	1·21
	2	0·94	0·86	0·95	0·87	0·86	1·05	1·09	0·58	0·72	1·05	1·00	0·73	1·10	1·20
	3	0·92	0·93	0·95	0·85	0·85	1·17	1·18	0·55	0·84	0·96	1·09	0·77	1·14	1·26
Mar.	1	0·90	1·16	0·97	0·94	0·85	1·03	1·12	0·55	0·80	1·10	1·02	0·79	1·13	1·35
	2	0·99	1·16	1·07	0·95	0·90	1·11	1·23	0·62	0·79	1·13	1·06	0·78	1·17	1·34
	3	1·10	1·18	1·10	1·04	0·75	1·22	1·17	0·68	0·95	1·07	1·09	0·87	1·28	1·34
April	1	0·96	1·13	1·10	0·90	0·90	1·11	1·10	0·65	0·84	1·13	1·06	0·93	1·29	1·22
	2	0·97	1·14	1·00	0·92	0·95	1·20	1·12	0·66	0·94	1·23	1·01	0·82	1·42	1·15
	3	1·07	1·18	0·99	1·00	1·00	1·19	1·20	0·74	0·85	1·17	1·00	0·85	1·36	1·16
May	1	0·96	1·18	1·07	0·85	0·98	1·08	1·24	0·72	0·99	1·11	0·97	..	1·41	1·21
	2	1·04	1·16	1·16	0·85	1·10	1·24	..	0·66	0·93	0·90	0·95	..	1·23	1·13
	3	1·03	1·15	0·99	0·91	1·21	1·10	1·12	0·69	0·92	0·91	1·03	..	1·27	1·20

In order to get a true knowledge of the losses of butterfat it is necessary to express these as a percentage of the butterfat handled. The fat in buttermilk free from added water figures do not give indication of any advantage that is gained through the use of high-testing cream, as is the practice in New Zealand factories. However, since the test from one factory to another varies but little, they do give a knowledge of the comparative losses.

Table 2 sets out the percentage butterfat losses at the fourteen factories month by month. These figures are calculated from the fat in buttermilk free from added water figures, and from the calculated quantity of this water-free buttermilk. The latter was calculated from the formula already mentioned, namely—

$$\text{Bm.} = W \frac{100 - 1{\cdot}12T}{100}$$

The total weight of butterfat received was obtained from the usual factory weights and tests of cream received.

TABLE 2.—PERCENTAGE OF FAT RECEIVED LOST IN BUTTERMILK.

Factory	Oct.	Nov	Dec.	Jan	Feb.	March	April.	Total, Oct.-April.
No. 1 ..	1·14	1·27	1·20	1·14	1·18	1·32	1·26	1·21
No. 2 ..	1·24	1·32	1·45	1 51	1·26	1·45	1·52	1·35
No. 3 ..	1·16	1·19	1·10	1·20	1 27	1·46	1·34	1·21
No 4 ..	1·08	1·02	0·99	1·16	1·18	1·29	1·22	1·11
No 5 ..	1·20	1·04	1·02	..	1·20	1·16	1·43	1·15
No. 6 ..	1·36	1·26	1·34	1·39	1·50	1·57	1·58	1·40
No. 7 ..	..	1·25	1·25	1·40	1·42	1·56	1·48	1·36
No. 8 ..	0·73	0·76	0·70	0·75	0·81	0·86	0·92	0·77
No. 9 ..	1·03	0·93	0·96	1·01	1·03	1·15	1·14	1·02
No. 10 ..	1·36	1·26	1·48	1·46	1 39	1·52	1·58	1·42
No. 11 ..	1·33	1·36	1·29	1·39	1·45	1·42	1·48	1·38
No. 12 ..	0·84	0 84	0·90	0 98	1·12	1·10	1·17	0·95
No. 13 ..	1·39	1·28	1 65	1·43	1·22	1·31	1·37	1·39
No. 14 ..	1·38	1·50	1·52	1·31	1·62	1·75	1·46	1·48

RESULTS OBTAINED.

The two tables presented give indication of the losses that are occurring at fourteen different butter-factories operating under different conditions of manufacture and of cream-supply A comparison of the figures shows that wide variations of losses of butterfat in buttermilk are occurring. The difference between the highest and lowest loss figure is 0·71 per cent., and this on a factory handling 1,000 tons of butterfat represents a saving of 7·1 tons of butterfat, which, at 1s. 6d. per pound, would be valued at £1,209. The actual differences in the loss figures that are occurring in the industry to-day are therefore of considerable importance. The facts demonstrated by the above figures might conveniently be expressed by saying that some factories are adding to the cost of manufacture, by as much as £1 per ton, by excessive losses in buttermilk over and above what better-controlled factories are doing.

In concluding, I would remark that the butterfat losses in large factories are of such importance that it would well pay a factory management to install milk-meters for measuring the daily output of buttermilk as it is delivered, and automatically sample same for daily testing.

Stock slaughtered on Farms—The stock slaughtered for domestic consumption on farm holdings during the twelve months ended 31st January, 1929, was as follows: Sheep, 527,705; lambs, 47,865; bullocks, 1,770; cows, 3,828; calves, 2,077; pigs, 46,.391

SEASONAL NOTES.

THE FARM.

Autumn Sowing of Pastures.

ONE of the most important autumn considerations on the farm is that of pasture seed mixtures. The research of later years has considerably modified the work of deciding upon the constitution of mixtures suitable for use over much of New Zealand. Fortunately the tendency has been towards simplicity, brought about both by a reduction in the number of species commonly used and by a reduction in the number of seed mixtures it is deemed necessary to employ. The changed position may be summed up by saying that now the tendency is to modify soil-conditions by manuring, draining, &c., to suit the best pasture species, rather than to adapt pasture mixtures to the soil conditions as they exist on the farm. The extent to which this can be practised is subject to important limitations due to climatic and economic considerations, but it can be done to a greater extent than would at first sight seem to many to be possible.

The changed position arises mainly from a fuller realization of the importance that may be assigned to top-dressing as an aid in grassland farming. For many years the natural fertility of the soil has been a large factor in determining the contents of seed mixtures and the results obtained from the mixtures. To-day, now that the farmer often has the influence of top-dressing available, the ingredients of pasture seed mixtures are being determined not so much by the initial fertility of the soil as by the soil moisture-supply, the climate, and the top-dressing plans which are made. Further, apart from the place being played by top-dressing in seed-mixture considerations, weight requires to be given to the fact that a relatively simple seed mixture may suitably be used over a fairly wide range of soil. This is because the species in the mixture which are suited to the particular fertility conditions will become dominant, while other species included will play a valuable though subordinate role.

Permanent Pasture.—The position is possibly best made clear by citing a seed mixture for the establishment of permanent pasture recommended by Mr. E. Bruce Levy, Agrostologist, Department of Agriculture, for use on fairly good-quality ploughable land over wide areas in both the North and South Islands. The mixture is: True perennial rye-grass, 20 lb. to 25 lb.; New Zealand cocksfoot, 10 lb. to 15 lb.; crested dogstail, 3 lb.; timothy, 3 lb.; New Zealand white clover, 2 lb.; red clover, 3 lb.: total, 40 lb. (All amounts given here in this and other mixtures are per acre.) The larger amount of cocksfoot is to be used only when the smaller amount of rye-grass is used. The smaller amount of rye-grass is used mainly when the summer rainfall is below that suitable for permanence of rye-grass, as under Canterbury or certain similar conditions; and, again, when fertility is below that demanded by rye-grass and cannot economically be raised to rye-grass standard.

This mixture is recommended for use on country with a carrying-capacity which is, or can economically be made, at the rate of one cow to 2 or 3 acres or better; or at the rate of two to three ewes to the acre or better. Such a mixture, if used on land of the higher carrying-capacity mentioned, would result in a permanent pasture in which rye-grass and white clover would be dominant. If used on land of the lower carrying-capacity it would tend to result in a pasture in which cocksfoot, dogstail, and white clover would be dominant, unless, when soil moisture-supply was favourable, it proved profitable to top-dress to bring fertility up to the standard of rye-grass and white clover dominance.

The mixture detailed above may advantageously be modified under certain special conditions. The following are cases given by Mr. Levy: On land of naturally high fertility, where the permanence and good growth of rye-grass all the year is known to be assured, cocksfoot may be omitted, as its presence would add to the difficulties of management. Poa trivialis, at the rate of 2 lb. per acre, is a species which should be included on high-class country which is inclined to be damp in the winter. Meadow foxtail is a grass of first-class value on fertile swamps where the winter conditions are too wet for rye-grass to thrive, and 6 lb. should be included for such conditions. However, it is recommended in respect to such land that, instead of sowing foxtail, if it is at all possible the land be drained and made habitable for rye-grass. Strawberry clover at the rate of 1 lb. may be added for use on salty marshy conditions, or it may be substituted for white clover on saline soil which becomes wet because of tidal action. In parts north of a line drawn across the North Island through New Plymouth, Hamilton, and Gisborne, paspalum, at the rate of 6 lb. to 8 lb., can replace cocksfoot.

Over a wide range of conditions manuring at the rate of 2 cwt to 3 cwt. per acre of high-class fertilizer at time of sowing-down will prove advantageous. During the past year a mixture of superphosphate and sulphate of ammonia has been found to give splendid results in this connection where the young grass tended to be slow in development because of late sowing or somewhat low fertility.

Temporary Pasture.—Autumn-sown temporary pastures of one to two years' duration are at times of considerable value, mainly because they can be sown (1) to yield green feed in winter or early spring; (2) to spell and build up the fertility of land which has been regularly under the plough; and (3) to clear land of weeds, such as blackberry, prior to the sowing of a permanent pasture. A popular suitable seed mixture for temporary pasture consists of Italian rye-grass, 25 lb., and red clover, 4 lb. to 6 lb.

Temporary pasture may be sown successfully in March where a rape, kale, or turnip crop has been fed off. Provided the land is reasonably clean, disking will serve to provide a soil layer sufficient to properly cover the seed. Italian rye-grass sown about March after producing good spring feed may later be shut up for a hay or a seed crop.

Short-rotation Pasture.—On arable farms where cereal and forage crops constitute a major consideration, and where it is not profitable to raise the fertility to a standard that would support permanently the mixture given above for the establishment of permanent pasture, then temporary pastures of two to three years' duration are often most advisable. These can be obtained by using the following mixture: Italian rye-grass, 10 lb.; perennial rye-grass, 10 lb.; red clover, 4 lb.; white clover, 2 lb.: total, 26 lb.

Bush-burn Sowings.—An important topical matter is the sowing to grass of bush-burn country. In respect to seed mixtures the two main matters are the sowing of the primary burn and of the secondary burn.

Primary burn mixture: For the sowing of the primary burn Mr. Levy recommends the following mixture: Cocksfoot, 8 lb; crested dogstail, 3 lb.; Italian rye-grass, 5 lb., true perennial rye-grass, 10 lb., Poa pratensis, 1 lb.; brown-top, 1½ lb., white clover, 2 lb.; Lotus major, 1 lb.; Danthonia pilosa, 3 lb.: total, 34½ lb.

The presence of Italian rye-grass may be disadvantageous on country that cannot be stocked early owing to lack of fencing, &c. If it is expected that it will not be possible to stock by the time the Italian begins to smother other species it will be better to put 15 lb. of perennial rye-grass in the mixture and omit the Italian altogether. Particularly

for the better type of hill country it is most advisable to use the better class of rye-grass—the true perennial In the past too much of the temporary type has been used. New Zealand cocksfoot is the best for permanence, which is desired for hill-country work. Danish cocksfoot would serve under conditions of rank growth, which should become a thing of the past on pastures both on the hills and on the flat Poa pratensis is valuable, more particularly for fertile country such as would carry a ewe and a half or more to the acre Brown-top is essential for less fertile parts of the burn, especially peaty areas where such trees as kamahi, rewarewa, and hinau were prominent in the bush that was felled New Zealand white-clover seed should always be used. Danthonia serves to take up the running, when other species disappear, on dry knobs and sunny faces—areas which are too poor for any of the other species included in the mixture. These areas always occur on bush burns. Danthonia comes into evidence where there is slow establishing and slow producing; if conditions are good enough it is kept suppressed and confined to the poor and sunny knobs. Canterbury Danthonia pilosa seed is more reliable from the purity and germination standpoint than that from any other districts. It is necessary to be careful to secure Lotus major seed which is reasonably pure and free from Lotus hispidus, which is not of much value for hill country and which is a common impurity in seed from certain districts—Auckland, for instance.

Secondary-burn mixture For the sowing of secondary bush-burns Mr. Levy recommends the following Rye-grass, 8 lb.; brown-top, 2 lb.; dogstail, 4 lb.; white clover, 1 lb.; Lotus major, 1 lb.; Danthonia pilosa, 3 lb.: total, 19 lb.

This mixture is suitable for typical bracken, hard fern, and manuka burns. Where fertility is higher, as on mahoe, wineberry, and fuchsia burns, also logging-up burns, the addition of 4 lb to 6 lb. of cocksfoot to the mixture is quite justified. On secondary burns rye-grass is included primarily to attract stock during the first six to nine months. It is doubtful whether the expense of the true perennial rye-grass is justified on the harder, poorer country, but if rye-grass is expected to be permanent, and especially if top-dressing is to be practised, then true perennial should be used. Under very dry conditions, such as obtain on much of the typical East Coast country, it is very doubtful whether Lotus major is worth while in mixtures for secondary burns.

It is better not to sow secondary burns before the autumn rains can definitely be expected; generally for the North Island this is about the middle of March. Hence in burning secondary growth it is well to make the main burning as late as possible at the end of February or the beginning of March.

In all secondary burns building up the fertility by top-dressing is highly beneficial in regard to establishment and subsequent covering by the pasture, and is also of great assistance in the control of reappearing secondary growth. Hence it is often advisable to top-dress in the autumn or early winter, as soon as the seed germinates, with superphosphate at the rate of 2 cwt. to 3 cwt. per acre.

General Points.—The results of recent work continue to emphasize the necessity for the use of true perennial rye-grass when permanence is desired. Hence, when available, certified seed should be used; if certified seed is not obtainable, efforts should be made to secure other seed of known permanent character.

The necessity for a fine, firm seed-bed is great, and if there is neglect in this respect unsatisfactory results may be expected.

Top-dressing at or about the time of sowing seed sometimes greatly assists in bringing about vigorous successful establishment.

In the case of young pastures, it is well to apply top-dressing early—in time to prevent the development of deterioration, rather than to have to apply fertilizer later on in an endeavour to build up pasture which has deteriorated.

It is well to remember that true Western Wolths rye-grass is essentially shorter-lived than Italian rye-grass, and as a consequence the yield for a year from Italian rye-grass is likely to be greater than from Western Wolths.

For the rapid production of feed, 1 bushel of oats or barley can at times be sown advantageously with temporary or short-rotation pasture mixtures.

The matter of rolling at seed-sowing time is a vexed one because of variation in conditions. One rule of some value is to roll under dry, fine conditions, and not to roll under wet conditions with frequent rain.

Management of Established Pastures.

In districts where a fair amount of rain usually falls in March topping of the pastures with the mower is advisable during March to remove patches of long, rank, or matured growth. The removal of such patches facilitates the development of a valuable, even, fresh growth consequent on the autumn rains.

A further aid to the development of such growth consists in vigorous harrowing, which may effectively be carried out during March or thereabouts. Harrowing at this stage is specially necessary and valuable because of the droppings which accumulate during the dry period, when usually it is inadvisable to harrow pastures. Much the better distribution of droppings is effected by harrowing up and down a paddock in one direction and then across the paddock at right angles. At this season harrowing of pastures commonly errs in not being severe enough.

The advisability of applying phosphates to grassland in March or thereabouts has been stressed and explained previously in these monthly notes.

Red clover spring-sown with cereals will benefit greatly in the autumn, when rains are assured, by a dressing of superphosphate.

Forage Crops.

Feeding should be planned so as to utilize maize, millet, and sorghum crops before the middle of April, so that danger of frost damage may be avoided. Any portion of these crops not required for autumn feeding should be made into ensilage, provided there is at least 25 tons of material available for this purpose. When less material is available millet may be made into hay, but with this crop, provided there is the required bulk to handle, ensilage is preferable to hay, partly because of the difficulty of drying safely the coarse material in haying. Even though there may be somewhat heavy wastage with ensilage, or difficulty with hay, it is better to make one or the other rather than to leave the crops standing until they are frosted and become a total loss.

Land having grown cereal or forage crops, such as oats, wheat, maize, millet, or soft turnips, should be ploughed immediately the crops are removed. If the land is too hard for satisfactory skim-ploughings, cultivation with the disks set with plenty of cut may pay handsomely.

Crops which often may be sown with advantage during March for the provision of winter and spring forage include the following . Algerian oats, about 2½ bushels of seed per acre ; Algerian oats, 1½ bushels, and Western Wolths rye-grass, 1 bushel ; black skinless barley, 2½ bushels. With all of these a dressing of 1 cwt. to 2 cwt. of superphosphate can usually be applied with profit.

The preparatory cultivation for autumn-sown crops should aim not so much to produce a finely pulverized layer of surface soil as fine soil below

the surface Provided this latter is obtained small clods on the surface are not a disadvantage, as eventually they will be broken up by natural weathering processes.

Lucerne.

During March a cut for hay or green feed can often be obtained from lucerne fields. After such a cut, if the lucerne is infested with weeds and the conditions are dry, it may be advantageous to run over it with tine harrows However, it is probable that on the whole more harm than good is done throughout New Zealand by surface tillage of lucerne, for often any tillage sufficiently drastic to remove persistent weeds may also be depended upon to destroy a number of the lucerne-plants. The number destroyed in any one season may not be very noticeable, but when destruction of lucerne-plants by cultivation is continued over a number of seasons quite noticeable thinning of the stand results.

When weed infestation definitely makes cultivation advisable, implements with narrow-pointed tines are preferable, in order to minimize injury to the lucerne.

Generally, mowing the crop at the proper stages liberal manuring, and refraining from grazing are preferable to surface tillage as means of combating possible weed invasion However, under certain conditions of friable soil, good results have been obtained by March tillage with harrows, followed by a light seeding of Italian rye-grass or Algerian oats In this case it is necessary to cut the resultant growth early in the spring for green feed or ensilage; if this is not done harmful smothering of the lucerne results — *R. P. Connell, M.A., Fields Division, Palmerston North.*

THE ORCHARD.

Spraying Operations.

Periods of moist, humid conditions such as are often experienced will occasion much anxiety to orchardists as the fruit approaches maturity. Given suitable atmospheric conditions, the appearance of ripe-rot and black-spot may be so sudden and the spread so rapid that it is wise to anticipate them and spray accordingly. The arsenate-of-lead sprays should be continued on the later-ripening varieties of apples and pears for codlin-moth, and powdery mildew will necessitate another precipitated sulphur spray.

Red mite and mealy bug will often become prevalent on apples as the season progresses, and as neither of these pests is permissable in export or local market fruit their control is imperative. The presence of mite is readily detected by the washed-out appearance of the trees, and the mites will be found mostly on the underside of the leaves and on the fruit, where they deposit their tiny, roundish, red eggs in the calyx cavity. Mealy bug is not so readily detected, as the eggs are laid in the fine web-like mass in the stem cavity. The value of effective early spraying is appreciated when these pests make their appearance, necessitating cessation of packing or greater vigilance in grading. Special summer oils have been found effective for this purpose, as also has Black Leaf and kerosene emulsion, but the tendency of oil to promote russetting, and of Black Leaf to leave unsightly blotches, makes careful application necessary. Ordinary spraying-oil may be used at not stronger than 1-100, thoroughly wetting the undersides of the leaves and the fruit. The addition of about 1 lb. of soap to each 25 gallons of water, by breaking up the oil globules, increases the spread and adhesiveness and reduces the tendency to spotting.

Fireblight.

In affected districts fireblight should receive constant attention. Infected portions are liable to be missed during the dormant pruning, and the work is expedited if done while the foliage is present. Large trees, whose limbs do not receive the individual attention that is given to small trees, are liable to have diseased portions overlooked during the dormant period, and from these sources fresh infection can be disseminated in the spring, and the value of the previous season's work is nullified.

Pruning.

When the growth is well advanced and while fruit is still on the trees is a good time to make a general inspection to note the results of previous season's pruning and decide on any variations or alterations in the methods adopted. The variation in fruiting-habit in different varieties is so great that an intimate knowledge of each variety's peculiarities is essential if maximum results are to be obtained. Observation as to what type of wood the best fruit is produced on, and how the tree has responded to pruning, will help to correct past errors and prevent a great deal of anxiety on the part of those which whom pruning is not a business. The desirability or otherwise of removing limbs from the centre of the tree can be decided best while the fruit is in position and indicating by its colour whether conditions are to its liking. Crowded centres are not desirable, but what may appear crowded in the dormant season is often sufficiently open when the weight of fruit bears each limb outwards, and a little attention then may prevent sacrificing valuable fruiting-wood at the dormant pruning. Pruning is performed to assist and direct nature, and to co-operate fully it is necessary to know just how her energies are directed.

Destruction of Diseased Fruit.

In the rush of picking and packing, the destruction of diseased fruit is sometimes delayed until a favourable opportunity presents itself. Where codlin-moth-infected fruit is present the delay may be sufficient to allow the grub time to migrate and establish itself in winter quarters. The difficulty in controlling codlin-moth in the vicinity of packing-sheds is undoubtedly often due to this cause, and in the interests of next season's crop no effort should be spared in dealing with these potential sources of future trouble and expense.

Cultivation and Cover-cropping.

Weed-suppression has been difficult so far this season, due to the moist conditions prevailing, and where cover-crops are not being used a heavy crop of seedling weeds may be expected. Cultivation should therefore be continued as long as circumstances will permit. Sowing with rye-grass can be proceeded with during suitable weather conditions. Sowing during normal February weather is often unsatisfactory, and to get the longest possible growing-season seed can be sown early in March.

Propping and Tying.

Props should be examined occasionally, and adjusted if necessary to ease the strain on the heavily laden limbs, and extra ties can be put in for further support. Apart from the damage to the trees, splits and fractures provide shelter for codlin-moth and points of entry for fungoids which may cause further loss. In exposed positions reworked trees should be staked to protect the grafts against winds. Budding should be pushed on and completed before the sap-flow ceases.

The tendency in the Delicious apple to produce fruit with open cores should be borne in mind when picking commences. These are subject to infection by fungoids, which produce the condition known as mouldy core

and often comprise a large proportion of the first fruit to ripen. Though they may be satisfactory for immediate consumption their keeping-qualities are impaired, and they should not be used for export or storage purposes.

Citrus-culture.

Cultivation will be the dominant work for the coming month in this section. The abundant rainfall has stimulated growth to a greater extent than usual, and it will be possible to replace more of the weak or exhausted wood with fresh young growth. Some attention should be devoted to thinning superfluous shoots before they harden, and to shortening any growths which appear likely to extend unduly.

Autumn manuring will be governed by the condition of the trees. The application of quick-acting nitrogenous manures to trees already developing a large amount of young growth will tend to keep the wood soft and increase the liability to frost injury. Citrus derive more benefit from bulky nitrogenous manures than from the more easily applied chemical product, therefore consideration should be given to sowing a crop for ploughing in. Late February and early March is the best time for sowing, and preference should be given to a leguminous crop. For this purpose lupins, peas, or clovers will provide a good bulk of vegetable matter and, in addition, an appreciable amount of nitrogen. Sowing should not be unduly delayed, for the maximum amount of growth is desired, and it will be necessary to plough the material in early in the season in order that it may decompose before the trees commence their spring growth.

Unfruitful trees or trees of poor type may be top-worked or budded over to more profitable kinds as soon as suitable bud-wood can be obtained. Shield budding into reasonably fresh bark on the main stems is generally satisfactory, and the limbs in which the buds are inserted may be shortened somewhat to check the sap-flow. In selecting buds it is important that wood should be taken from trees of good habit that produce a desirable type of fruit. Strong-growing fleshy shoots and trees prone to developing excessive wood should be avoided, as these characteristics will be perpetuated in the new tree to the detriment of fruit-production. Short twigs on which fruit has been produced will provide the best bud-wood, which for satisfactory working should be round and free from thorns, with good plump buds. Triangular or flanged wood is not suitable, inasmuch as a sufficient width of bark cannot be obtained, and it is almost impossible to remove the surplus wood without damaging the eye. In budding seedling stocks it is important that the bud be inserted at least 9 in. above the ground-level to ensure that there will ultimately be a sufficient length of stock to protect the more susceptible variety against infection by soil-inhabiting fungi such as collar-rot.

G. H. McIndoe, Orchard Instructor, Gisborne.

POULTRY-KEEPING.

Care of the Maturing Pullets.

On all premises where the early-hatched pullets are approaching the point of laying there should be no delay in placing the birds into their permanent winter quarters. This is now of paramount importance, for any change when the young bird is about to commence laying is apt to cause an early moult, and consequently a loss of autumn and winter eggs. An untimely moult will also be brought about if the ration provided is suddenly changed, and it must be borne in mind that the management of the pullet from which winter eggs are expected must be uniform in every direction. For this reason the sooner all the well-developed pullets are placed in their future

permanent quarters, and become accustomed to a regular diet, the less risk will there be of their moulting with the adult fowls and ceasing to lay when better prices for fresh eggs prevail.

Where the birds are well developed and nearing the laying-point it is a wise course to include in the ration by degrees some forcing diet such as meat or meat-meal; but the poultryman should on no account let the increasing price of eggs tempt him to unduly force the eggs until the birds are well settled down to their business. This should be particularly guarded against where a rich ingredient is included in a mash mixture. The best course to adopt is to provide the forcing-material separately, so that each bird may take what it requires and no more. In this way the bird will balance its own ration better than one can do it for her, for usually the ingredient that she likes is what she needs for producing a maximum egg-yield. Where a bird is forced to eat in a mash an excess of any forcing-material in order to secure a meal ovarian troubles such as protrusion of the oviduct will result, as well as the production of shell-less and double-yolked eggs.

Culling.

March may be regarded as the best month of the year for culling out unprofitable hens. In ordinary times efficient culling is one of the chief essentials if the business of poultry-keeping is to be made really profitable. The prevailing high cost of foodstuffs, however, in combination with the low price of eggs, makes this important work really essential, and if not properly carried out it may easily mean the difference between showing a profit and a loss

The reason for stating that during March is the best time for culling a flock of hens is that at this period of the year—towards the termination of the laying-season—certain signs manifest themselves in individual birds as indicative of their laying-capacity. These signs are not only a good guide as to whether a bird is in a laying condition or not, but they also indicate to a great extent whether she has produced heavily during the past laying-season, and, further, whether or not she is likely to prove a good layer during the following season.

The experienced person who has a natural eye for form can quickly observe the change that takes place in the appearance of individual birds. This faculty of discriminating between the good and the poor hen, however, is one which may be developed by observation and study, and, better still, by first being given a practical demonstration by a person of experience. Once this qualification is acquired its value to the poultry-keeper cannot be overestimated. It enables him not only to eliminate poor producers from his flock, but also to select the best specimens for the all-important work of reproduction. These guides can be made use of only previous to the time of moulting, as no single characteristic of a bird can be judged with accuracy once the moulting process has begun.

There should therefore be no delay in carrying out a thorough culling campaign. Generally speaking, a safe principle to be guided by in culling is to eliminate all birds showing weakness in constitution, for no matter how well a bird has laid or how good the type she must necessarily prove disappointing as a layer, and to a greater degree as a breeder. once her vigour has become impaired. Obviously for a bird to continue heavy egg-laying (which is an artificially produced condition and causes a severe tax on the reproductive organs) health and vigour must stand foremost as compared with pedigree of performance, desirable type, or indeed anything else. A bird may prove to be a first-class egg-layer, but if in this effort her vigour has been weakened she should be rejected as a breeder, and it will seldom pay to keep her for any other purpose.

The period of moulting gives a good guide to the constitutional vigour and laying-capacity possessed. It is the long-season layer, the bird that

lays well in other than the natural laying-season (spring and summer)—that is desired and is the most profitable to keep. To do this a bird must necessarily be a late moulter, as the laying-season usually ends when the moulting-period begins. Therefore the birds that show evidence of being early moulters should be culled out and the late moulters retained for laying and breeding purposes. It must be remembered that this test only applies when the birds have been hatched at about the same time, and have been fed and managed under similar local conditions. For example, when first- and second-season layers are running together it will usually be found that the former will moult first, so that some allowance must be made for this. Especially is this so where the older birds have been selected as late moulters in the previous season. An early moult may also be caused by broodiness and by allowing a bird to sit on the nest for weeks at a time. A sudden change of food or quarters is also apt to have a similar effect at this period of the year. No rule is capable of universal application, however, and exceptions must be allowed for in applying the moulting test in the work of culling.

Apart from early moulting there are other signs suggestive of poor laying-capacity. These include an overfat condition, loose feathering, dull sunken eye, an inactive appearance, and poor development in the abdominal region. In the case of breeds with yellow legs it will generally be found at this season of the year that those birds which have lost the deep-yellow colour—the legs having become more or less white and bleached-looking—are the best layers, and the strongest birds in the flock, whereas those with legs of a rich yellow are the drones. It must be noted that this sign only applies towards the end of a bird's productive season, for after it has moulted the legs will soon regain their yellow appearance. The fact that the legs of the good layers become more or less bleached as compared with those of the poor layer is no doubt due to the yellow fat being drawn from them to supply the egg-yolk with its yellow pigment. Obviously the greater the layer the greater will be the tax on the fat content of the legs, and consequently the more bleached the legs will become. What applies in the case of the legs does so in like degree to the body-skin, particularly about the vent, and also to the beak. It may be mentioned that hens running on a grass range do not usually bleach out in the legs to the same extent as those kept in confinement. As is the case with early moulting, leg-colour is not always an indication of the conclusion of the individual fowl's normal laying period, and here again local conditions must be taken into account in applying the test.

In addition to being a late moulter, the high-type layer will usually present the following signs indicating laying-capacity and constitutional vigour: tight feathering, bright prominent eyes, clean face (often the head being devoid of feathers, a sign seldom or never found in a low egg producer), deep abdominal development with fine texture of skin, well developed crop, an active businesslike appearance, a more or less lean condition, and a worn-out, unkempt, rough-and-ready plumage. The reason for this is obvious, in that a hen could not be expected to lay on fat while producing a maximum egg-yield.

Summarizing the foregoing points, the birds that should be culled are those that show signs of moulting; those with a well-kept plumage, and which are above the normal weight of their breed; those with hard development in the abdominal region; and those with signs indicating a weak constitution, such as a dull sunken appearance of the eyes, heavy well-feathered eyebrows, bright-yellow legs, loose feathering, and sluggish appearance.

Selection of Breeding-hens.

It should not be taken for granted that because the weak types have been eliminated from the flock and only useful birds remain on the plant all of the latter are suitable for the breeding-pen. A bird may show

abundant evidence of possessing productive power, but something more is required. Obviously, if everything is sacrificed to egg-yield the other important points in the make-up of a good breeding specimen will suffer as a consequence.

Combined with the desired constitutional points and features pointing to laying-capacity, due consideration must be given to breed characteristics. If a uniform heavy-producing flock is to be built up and maintained, an ideal type, in addition to productive capacity, must be aimed at. It should always be borne in mind that the best layer is not necessarily the best breeder. Always avoid selecting for the breeding-pen undersized specimens of the breed, even although such birds have proved themselves to be good layers. They may succeed in a laying test, or even break records, but it is seldom or never that they will produce desirable progeny. It is always a good plan to choose for the breeding-pen a hen slightly larger than that desired in a laying flock. If this golden rule was practised more by the majority of our poultry-breeders, instead of making egg-yielding power the one and only consideration when selecting their breeding specimens, we would hear less about exporting 1¾ oz eggs to the overseas market from those concerned in the export trade. If any argument is required to prove the fallacy of breeding from undersized specimens of their breed and producers of small eggs, then it is surely contained in the fact that there was a difference of 9s. per case of 30 dozen realized on eggs recently exported to London, and which weighed 17 lb and 14 lb respectively.

The novice who is really anxious to build up a high-standard flock of layers will be well advised to secure a copy of the "New Zealand Utility-poultry Standards," obtainable from the Department of Agriculture at a cost of 3s., post free. This contains plates illustrating the types that should be aimed at when mating stock, together with desired weight clauses and general standard requirements.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Final Extracting for Main Honey-flow.

FEBRUARY will probably see the end of the main honey-flow in most districts, and beekeepers will be wise to remove the last of the honey before the colder nights arrive. Once the honey in the hives has been allowed to become thoroughly chilled there is little prospect of its becoming warmed again when uncertain weather sets in. Wherever inclined to be thick the honey will be found exceedingly difficult to extract unless it is warm, and the beekeeper who delays too long will find that he will have to return to the hives combs almost as heavy as when they were removed. Thin honey extracts best when it is warm, but it is imperative that thick honey be not allowed to cool before extracting.

Condition of the Brood-chamber.

One of the principal matters to be attended to when the last of the honey is being removed is the condition of the brood-chamber. Many prolific queens keep the brood-chamber so full of brood throughout the season that the bees have very little room to store honey in it. Consequently if all the honey in the supers is removed such colonies stand a chance of being starved out before the end of the winter. These colonies should not be reduced to less than two stories, and on no account should their stores be less than 30 lb to 40 lb. It must be borne in mind that all the brood

in the hive will hatch and must be fed, and that in addition the queen will continue laying for some months to come, while in some districts breeding may continue throughout the winter. To ensure the colony coming out strong in the spring it must be left with ample stores to carry it through the months of dearth. Unless there is ample evidence of an abundant autumn flow the beekeeper would be wise to leave his hives oversupplied rather than undersupplied.

Use of Bee-escapes.

For the comb-honey producer the Porter bee-escape is an invaluable aid in the removal of his crop. Removal of comb-honey by the ordinary method of brushing, &c., is apt to result in the piercing of many cell-cappings, with constant leakage; but by the use of this simple little appliance, fitted in a board the size of a super, comb-honey can be removed without any disturbance of the colony. The super or supers should be prized up from the brood-chamber, two or three puffs of smoke driven into the hive, and the board gently slipped into place with the round hole of the escape uppermost. If this is done in the afternoon, by morning the super will be empty of bees.

Prevention of Robbing.

The taking of the last of the honey is the time when the beekeeper must display endless caution to prevent robbing. A bad attack of autumn robbing is—next to disease—about the worst thing a beekeeper can experience. Before starting the day's work he should have all appliances handy, have formed a plan of how the work is to be carried out, and should, if satisfactory, adhere to that plan throughout the day. A light barrow fitted with a tray to catch honey-drips, and two or three cloths of a size to cover the whole of a super are some of the things which will obviate much trouble. As the combs are removed from the supers they should be brushed and shaken as free of bees as possible, placed in an empty super on the barrow, and covered with a damp cloth. Close every hive as soon as it is finished with, and remove the combs to the honey-house, which should be bee-proof. At the close of the day the wet combs should be returned to the hives as expeditiously as possible, and by morning the apiary will be found to be in its normal condition. No pieces of wax, spilt honey, or anything likely to attract the attention of the bees should be left uncovered.

If the bees show a tendency to pounce on any particular hive the entrance should be contracted considerably and wet grass piled in front of the hive. If working in one portion of the apiary should cause robber bees to become too attentive it is advisable to shift the scene of operations to another part. It must be borne in mind that autumn robbing once commenced is hard to check, also that it is usually brought about by careless manipulation of the hives.

Weak Colonies.

As far as possible, weak hives should not be tolerated during the winter months. During the warm days these stocks rarely escape the attention of robber bees, and are easily molested. Once they are attacked it is exceedingly hard to save them, and despite the efforts of the beekeeper they eventually get robbed out. It is usually the presence of weak hives in the apiary that starts autumn and winter robbing, and it is by far the best plan to unite them with stronger colonies in the apiary and avoid the risk of creating a disturbance among the bees when normal winter conditions should prevail. If weak colonies are not detected until late in the season a good plan to follow when uniting them is to put the weak hive on top of a strong one, placing a piece of newspaper between the two hive-bodies. In the course of a few days the bees in the weaker hive will eat their way through the paper and unite peaceably with the bees in the stronger hive.

The surplus combs may subsequently be removed, and the hive made snug for wintering. If weather conditions permit, it is advantageous to destroy the queen in the weaker hive prior to uniting.

Preparations for Winter.

As soon as the last of the honey is removed the beekeeper should see that the colonies are in good order for wintering. The first matter for attention is that of stores, which, as already indicated, should be abundant; the second that of the queen's condition After these two important matters are settled the beekeeper should satisfy himself that his hives are water-tight and draught-proof, also that his apiary is well provided with shelter in the form of good hedges or other windbreaks

With regard to the queen, autumn is the time when strict attention should be paid to weak and failing queens. None but the best queens should be allowed to go into winter quarters. Poor queens should be destroyed, and either superseded by young and vigorous ones or their colonies united with those of the better queens before the winter sets in. No queen should be tolerated which cannot provide the colony with an abundant supply of young workers before the cold weather arrives. It is quite certain that the queen which goes back in the autumn will be in worse case after the winter, and will not produce enough workers to provide a surplus in the following season, even if she does not fail entirely before the spring or develop into a drone-layer as soon as brood-rearing commences.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

The Tobacco Crop.

As the season advances, and lower temperatures with increased humidity are experienced, the management of the leaf that is being air-cured must be adapted to the changing circumstances. During foggy nights and wet days the sheds should be closed, except for a minimum ventilation at the top, and smouldering fires of dry hardwood started in trenches in the ground. With a rising barometer and dry winds the ventilation must be increased again. It is only by careful regulation of this kind that suitable conditions can be maintained and curing brought to a conclusion without delay. Until the crop is bulked down under good conditions it will demand constant attention. This will be best given if the curing management is the responsibility of one individual.

When the leaf is cured to good colour and thoroughly dried out it should be conditioned and bulked down at once. Perhaps no operation is generally performed in so unsatisfactory a manner as this conditioning, and heavy losses are incurred annually by handling leaf in a more or less dry state, by which method it is torn and damaged and waste accumulates.

Dry leaf, in a cool state, readily absorbs atmospheric moisture, and by doing so its texture changes from that which is comparable to the thinnest and most delicate egg-shell, and is as easily crushed, to that of a piece of silk which may be squeezed in the hand without injury and resumes its natural fold as soon as it is released. In this latter state only can it be safely handled for grading, tying into hands, and bulking down. If this leaf is tested it will be found to contain about 12 per cent. of moisture; more than this quantity is apt to damage the leaf after bulking by causing a dangerous temperature, spoiling colours, and even destroying the texture. For this reason the point demands the nicest care to properly

condition not merely a portion but the whole quantity of leaf that is about to be graded and bulked. The requisite condition may be obtained alternatively by admitting steam into the building, by placing the leaf in a cellar overnight, by opening ventilators and admitting air in a humid state, or by wetting the floors. As soon as the requisite condition is obtained the leaf should be stripped from the stalks, graded, tied into hands, and bulked down.

Commercial grading of tobacco-leaf requires demonstrating to be properly understood, but the chief points are texture and colour Leaves of fine texture and heavy body are kept separate In each of these classes the colours lemon, yellow, orange, red, and mottled are separated again, and tied in hands of fifteen to twenty leaves of the same colour. A well-lit apartment is required for this work.

The operation of tying leaves together into hands is often done in a careless manner, and values are often depreciated on this account, as such tying is usually an indication that the leaf generally has been given indifferent treatment. The binder should have the bright side of the leaf outermost, the ends of the stems should be even. Commence binding with the tip of the binder leaf, carry the bandage for a short distance along the stems, and bring the butt of the binder stem firmly through between the middle of the leaves forming the hand. If the stems of the leaves being tied are coarse and long they should be placed together and shortened by cutting before being bound

As before stated, a room for bulking down should be thoroughly dry, clean, warm, and not subject to sudden changes of temperature. Specially should the floor be dry, close, and well up off the ground If there is any doubt on this point a platform 1 ft. or so high should be made on which to build the bulk. Make the stacks about 4 ft wide, placing the hands with the butts towards the outside, and the tips of the leaves slightly overlapping. Build up the stack with straight sides to a height of about 4 ft. (when compressed), and place a few boards on top with a moderate weight to compress the stack. For a week or two it should be examined occasionally to see it does not heat unduly. If the temperature rises over 80° F. the stack should be taken down, aired, and rebuilt. To prevent the leaf drying out or the light spoiling the colour the bulk should be covered with canvas or a waterproof material Small quantities may be bulked down in a clean packing-case of a suitable size.

Tomatoes and Small Fruits.

The disease of tomato-plants caused by the fungus *Septoria lycopersici* has been prevalent to some extent this season. The trouble is commonly known as tomato leaf-spot, and where the crop is in poor condition its appearance is serious, otherwise a few applications of a good bordeaux mixture at rather short intervals will go a long way towards holding the disease in check while the crop is maturing.

A disease of small fruits that has been rather common is strawberry brown-rot. This disease, the Department's Mycologist informs us, is caused by a *Botrytis*, probably *B. cinerea*. The spores are omnipresent, and specially destructive in warm, cloudy weather, wet seasons, and badly drained land, also when planted close in a sheltered place. In localities where wet conditions are common effective ditching and careful spacing should be observed. Also, in spite of all the advantages claimed for shelter-belts, it is to be remembered that high trees around small areas in such localities are entirely unsuitable.

In the preparation of land for planting small fruits it is well to remember the crop depends very largely on the quality and amount of the preparation, especially for plants that remain on the land for a few years. To plough heavy land when it is too wet, and especially when its humus content is

low, is a very serious injury. Land of that class requires every consideration, to an extent that a grower used to light land is unlikely to appreciate. Deep cultivation is almost always an advantage. Not that the subsoil should be turned up to the top—that has been repeatedly shown to be a serious disadvantage—but a subsoiling method that breaks up the subsoil without bringing it to the top improves drainage and deepens fertility. Land of this class is also slower in absorbing surface water, and a well-thought-out scheme of ditching will confer great benefit in improving the conditions for cropping. From these remarks it will be seen that the work of preparation is not to be deferred and performed hurriedly at the last minute—that is, if good results are to be expected.

The Market-garden.

In northern districts, where it is the practice to sow the onion crop in the autumn for planting out in early spring, the seed may be sown now on a piece of land that is well drained, clean, not too rich, and well firmed ; sowing should be thin. In the warmer districts it is not too late to sow seed-beds for a crop of the valuable spring cabbage, for planting out in the month of May.

As soon as a crop is harvested sow down the land in a cover-crop if it is not required for another purpose immediately. Remember this is one of the best and cheapest manures ; in fact, in the absence of stable manure nothing else will give the same results.

Clean the young winter crops by hoeing in fine weather, and commence blanching the celery crop as it approaches maturity. Before doing this supply such water and manures as may be required.

The *Sclerotinia* fungi have been troublesome in a number of garden crops during the spring. The rather varied phenomena it produces in its victims is very striking. In a crop of spring lettuce it caused a soft rot of the roots ; in a crop of radishes the effect was to contract and distort the edible root, while in the tomato crop its most familiar aspect is that of a canker just above the soil on the main stem. Such diseases as this compel one to weigh the respective merits of soil-sterilization and rotational cropping.

The Home Garden.

New lawns sown down at the present season run fewer risks of failure or delayed development than at any other period. This statement applies with little modification to the whole of the month of March. Suggestions for sowing lawns given last month should be noted. Carefully consider the matter of grades and levels before sowing. Nothing gives a garden a good appearance so much as well-chosen grades and a smooth surface on the lawns.

Carefully fork over the new shrubbery and herbaceous borders to clean them of twitch and all bad weeds. Work in such manures as may be necessary, and otherwise complete the preparation for planting trees and shrubs in the month of May.

—*W. C. Hyde, Horticulturist, Wellington.*

Standard Mark for Ryeland Sheep Society.—The Director-General, Department of Agriculture, notified in the *Gazette* of 23rd January that, in terms of section 3 of the Stock Amendment Act, 1927, and of the Standard Marks Stock Regulations, 1929, he had registered in the name of the Ryeland Sheep Society of New Zealand the brand or mark " R.N.Z. " as a standard mark to be placed, by means of tattoo with Indian ink, on the right ear of stock which, in the opinion of the society, is of a standard of merit fixed by it.

WEATHER RECORDS: JANUARY, 1930.

Dominion Meteorological Office.

GENERAL NOTES.

JANUARY was a most unseasonable month. Unsettled weather prevailed with only a few short breaks. Cloudiness and the number of wet days were much above the average, while sunshine was considerably below it. Temperatures fell below the normal for January by an unusually large amount. Rainfall was almost everywhere in large excess. The only exceptions to this rule were in parts of North Auckland, the Bay of Plenty, and Southland. The month was, in fact, the wettest January since that of 1923, which was the wettest so far recorded. At Auckland, Timaru, Geraldine, and a few other places, record falls for January were experienced.

Though weather of the westerly type has again been less predominant than in ordinary years, the two spells experienced were quite sufficiently vigorous samples. The first occurred during the first week of the month. The principal depression of this series was a deep V depression which crossed New Zealand on the 4th. On that day there were widespread northerly gales Very heavy and general rain fell on the 3rd and 4th. In the Thames Valley there was some flooding, and the Mangamahoe Dam in Taranaki was damaged by a cloudburst On the 5th, though there was less rain, there were some severe hailstorms in Canterbury, Marlborough, and Wellington

The second westerly spell lasted from the 19th to the 22nd. Northerly or north-westerly gales were particularly severe. At Wellington the twenty-four hours ending at 9 a.m. on the 21st was one of the windiest ever experienced. In Canterbury, also, the high winds caused some damage. Very heavy rain fell on the ranges of the South Island during this period, and there were considerable snowfalls on the high levels. Thunderstorms were recorded at many places. A combination of rain and snow in a thunderstorm and a north-westerly gale was responsible for the loss of five lives on the Tasman Glacier on the 19th. At Auckland, on the 21st, a torrential downpour caused flooding in some of the city streets. The steamship "Awarua" was struck by a thunderbolt while at Half-moon Bay, Stewart Island, on the 20th.

During the remainder of the month the storm systems were mainly of cyclonic form. On the 8th a shallow cyclone developed in the Bay of Plenty, and deepened rather rapidly through the night. At the same time a rather intense anticyclone crossed the southern portion of the South Island. The result was that strong southerly or south-easterly winds suddenly set in, and rose to gale force in places, especially in Cook Strait. Temperatures fell sharply, bringing on an unusually cold spell for the season of the year. Rain was almost general, with many heavy falls between the 8th and the 11th, especially on the 8th and 9th, eastern districts receiving the highest totals. On the night of the 8th snow fell on the mountain-tops of the South Island, and hail was recorded at places.

Another cyclone approached New Zealand on the 14th and passed through Cook Strait on the 15th. Except in the far north and the south-west, there was again general and heavy rain. Falls were particularly heavy in Canterbury, where there was much flooding. In the Ashburton County the floods were the heaviest known.

Almost general rains with many heavy falls, especially in the South Island, were again experienced on the 27th and 28th, when a cyclone moved across Canterbury.

Thunderstorms were rather numerous during the month.

RAINFALL FOR JANUARY, 1930, AT REPRESENTATIVE STATIONS

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
	North Island				
		Inches		Inches.	Inches
1	Kaitaia	2·46	10	0·81	3·36
2	Russell	2·19	11	0·47	4·11
3	Whangarei	2·76	12	0·83	4·08
4	Auckland	8·40	14	1·74	2·66
5	Hamilton	5·51	15	1·70	3·94
5A	Rotorua	9·91	15	2·59	4·30
6	Kawhia	7·13	16	2·46	3·52
7	New Plymouth	5·13	20	1·24	4·42
8	Riversdale, Inglewood ..	11·23	18	3·63	7·43
9	Whangamomona	8·52	19	2·37	6·05
10	Eltham	5·69	17	1·37	3·92
11	Tairua	2·87	9	0·61	4·35
12	Tauranga	5·52	12	1·59	4·34
13	Maraehako Station, Opotiki	3·58	14	1·72	4·20
14	Gisborne	3·11	8	1·02	2·97
15	Taupo	4·29	12	1·58	3·71
16	Napier	4·94	11	1·66	3·18
17	Maraekakaho Stn., Hastings	4·41	11	1·75	2·29
18	Taihape	4·04	21	0·58	3·28
19	Masterton	6·32	18	1·89	2·69
20	Patea	5·16	18	0·88	3·79
21	Wanganui	3·90	10	1·20	2·87
22	Foxton	2·91	13	0·56	2·30
23	Wellington (Karori Reservoir)	6·41	19	1·44	3·31
	South Island				
24	Westport	4·61	19	1·23	8·20
25	Greymouth	6·84	17	1·59	9·03
26	Hokitika	7·00	17	1·18	9·87
27	Ross	9·81	17	2·00	12·04
28	Arthur's Pass	24.40	13	10·14	9·36
29	Okuru	8·17	15	1·38	12·86
30	Collingwood	10·75	17	3·14	6·95
31	Nelson	5·76	14	2·59	2·82
32	Spring Creek	5·35	12	1·95	2·22
33	Tophouse ..	7·86	21	1·18	5·14
34	Hanmer Springs ..	7·07	19	1·22	3·74
35	Highfield, Waiau ..	6·20	13	1·54	2·95
36	Gore Bay	5·28	14	1·66	2·71
37	Christchurch	5·08	16	1·52	2·21
38	Timaru	6·38	19	2·14	2·30
39	Lambrook Station, Fairlie ..	5·78	15	1·34	2·38
40	Benmore Station, Clearburn	2·95	14	0·59	2·77
41	Oamaru	2·25	16	0·53	2·11
42	Queenstown	3·69	15	1·35	2·72
43	Clyde	..	..	..	1·72
44	Dunedin	4·25	19	0·71	3·36
45	Wendon	2·29	13	0·60	3·22
46	Gore	..	..	..	3·09
47	Invercargill	3·91	20	0·60	4·01
48	Puysegur Point	8·41	22	1·70	7·22
49	Half-moon Bay	6·05	16	1·21	4·68

—*Edward Kidson, Director of Meteorological Services, Wellington, 6th February, 1930.*

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR JANUARY, 1930.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season		
				Days	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs dys	lb.		lb	lb
Erinview Doree	J Murray, Woodville ..	2 68	247·3	365	9,813·8	630·08
Ngahiwi Lady Romance	W. J Freeth, Waitara ..	2 18	242·3	365	9,438·1	625·25
Waipiko Jubilant ..	C G. C. Dermer, Cheltenham	1 285	240·5	365	9,590·6	570·25
Ngahiwi Sunshine ..	W J Freeth, Waitara ..	1 359	240·5	365	7,991·7	505·12
Ngahiwi Fancy ..	W. J. Freeth, Waitara ..	2 8	241·3	365	7,623·6	490·19
Waipiko Cullana ..	C. G. C Dermer, Cheltenham	2 18	242·3	365	9,798·7	477·79
Te Kinga Sunbeam* .	R. S Tuck, Waharoa ..	2 54	245·9	365	6,350·4	466·13
Waipiko Charm .	C G C. Dermer, Cheltenham	2 46	245·1	365	9,106·9	452·64
Ngahiwi Lady Bronze	W J Freeth, Waitara .	1 346	240·5	365	9,250·2	446·06
Lea Rig Fringe ..	A. C. Christie and Co., Hikurangi	2 54	245·9	365	9,066·3	440·53
Waipiko Consequence	C G. C. Dermer, Cheltenham	1 325	240·5	365	8,092·7	439·21
Ngahiwi Lady Eleanor	W. J. Freeth, Waitara .	1 333	240·5	365	7,555·7	437·57
Jersey Farm Freda .	H. R Benbow, Ormondville	2 33	243·8	365	8,531·1	433·56
Jersey Farm Gem ..	H. R Benbow, Ormondville	2 27	243·2	365	6,878·6	377·32
Ngahiwi Sweet Ease	W J. Freeth, Waitara ..	2 76	248·1	232	6,142·8	352·10
Wattle Grove Ivy ..	W. Robinson, Patumahoe ..	2 49	245·4	362	5,818·8	338·58
Flat Park Perfection	R. Wattam, Cambridge ..	2 17	242·2	352	7,294·3	338·12
Conandale Easter Wonder	S Dale, Fairlie ..	1 353	240·5	293	4,578·9	264·90
Wattle's Hearty ..	D. J Willis, Greatford ..	1 333	240·5	263	4,815·7	254·00
Senior Two-year-old.						
St. Marino Lassie .	G. M. Harris, Hikutaia .	2 320	272·5	365	9,982·6	611·14
Huia Buttercup ..	H. G Lever, Tauranga ..	2 128	253·3	365	8,186·8	414·37
Burnside Darling ..	S. J. Hollard, Rowan ..	2 291	269·6	355	5,334·2	320·32
Three-year-old.						
Alfalfa Zenith ..	T. and A. Smith, Otorohanga	3 347	311·7	365	10,302·5	574·65
Moss Rose of O.K. ..	A. E Watkin, Takanini ..	3 364	313·4	336	9,603·9	527·63
Waipiko Curious ..	C. G. C. Dermer, Cheltenham	3 355	312·5	360	8,484·7	518·30
Dainty Lady of O.K	A. E. Watkin, Takanini ..	3 253	302·3	365	10,204·7	513·27
Velebit Fox's Freda*	G. E. Yelchich, Waiuku ..	3 174	294·4	365	7,909·9	500·59
Tyntesfield Eunice ..	R K. Garland, Okauia ..	3 98	286·8	365	7,755·7	497·06
Joyeuse of O K. ..	A. E. Watkin, Takanini ..	3 358	312·8	365	9,274·5	490·10
Orange Dale Rower's Beauty	Estate of W. J. Hall and Son, Matatoki	3 313	308·3	281	8,112·6	458·04
Four-year-old						
Ivondale Darling ..	R. S. Tuck, Waharoa ..	4 21	315·6	365	12,044·5	676·77
Waipiko Butter Girl..	C. G. C. Dermer, Cheltenham	4 342	347·7	365	10,744·6	616·96
Mature.						
Daisy's Buttercup* ..	Estate of G. H. Selby, Waiuku	10 30	350·0	365	14,811·5	820·94
Middlewood Gladful	A. G. Somervell, Takapau..	6 76	350·0	365	13,000·8	728·31
Reid Park Daylight	W. Craig, Waiuku ..	6 53	350·0	365	10,991·1	669·23
Grafton Fuchsia ..	Mrs. V. A. McIlveen, Taupaki	7 290	350·0	347	11,026·9	625·97
Waipiko Buttermaid	C. G. C. Dermer, Cheltenham	10 61	350·0	365	11,370·1	593·07
Orange Dale Alice ..	Estate of W. J. Hall and Son, Matatoki	6 36	350·0	360	9,552·7	515·22
Brooklyn Neat Maiden	H. J. Lancaster, Glen Oroua	6 9	350·0	332	9,419·4	519·26

LIST OF RECORDS—*continued*.

Name of Cow and Class	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat
	JERSEYS—*continued*					
Mature—continued.		Yrs. dys	lb.		lb	lb.
Oaklands Lady Brampton	F. W Cornwall, Bell Block	6 296	350·0	329	9,820·4	543·29
Marshlands Tango Fern	A E. Watkin, Takanini ..	6 8	350·0	365	10,244·0	519·1c
Burnside's Lady Twylish	S. J Hollard, Rowan ..	8 197	350·0	311	7,428·5	365·64
	FRIESIANS.					
Junior Two-year-old.						
Rosevale Jessica Sylvia*	H North and Sons, Omimi	2 171	257·6	365	17,871·5	641·32
Rosevale Catrina Posch Echo*	H North and Sons. Omimi	2 123	252·8	365	18,470·7	624·71
Greenhill Sylvia Rose 4th*	C. J Neville, Clandeboye ..	2 104	250·9	365	14,843·4	603·35
Lenslea Cloverette Nancy*	L. H Leslie, Bennetts .	1 341	240·5	365	14,040·3	536·18
Forestvale Sylvia Mimosa†	Messrs Tait Bros, Greenhills	2 29	243·4	365	15,127·7	519·53
Greenhill Alcartra Sylvia 3rd*	C. J. Neville, Clandeboye ..	2 16	242·1	365	13,919·0	462·46
Oakview Colantha Sylvia	Oakview Stud Farm, Auckland	2 5	241·0	365	13,265·9	446·08
Sealands Alcartra Corona	H. G A. Cameron, Weraroa	1 357	240·5	352	9,538·6	388·03
Dominion Olga Segis	Central Development Farm, Weraroa	1 342	240·5	237	9,639·4	364·00
Dominion Woodcrest Daisy Queen	Central Development Farm, Weraroa	1 355	240·5	249	9,582·6	347·59
Dominion Domino Carnation	Central Development Farm, Weraroa	2 21	242·6	237	8,384·0	259·64
Senior Two-year-old.						
Rosevale Lady Abbekerk Posch	W. Bryant, Otokia ..	2 228	263·3	318	11,149·6	360·87
Rosevale Lassie Posch II	W. Bryant, Otokia ..	2 331	273·6	345	10,529·3	333·77
Junior Three-year-old.						
Rosevale Queen Daphne Triumph*	H. North and Sons, Omimi	3 172	294·2	365	17,896·4	648·21
Senior Three-year-old.						
Totara Pontiac Lady*	Piri Land Co., Auckland ..	3 364	313·4	331	15,397·1	699·98
Rosevale Sylvia Plus Keyes*	H. North and Sons, Omimi	3 282	303·2	365	19,485·1	660·57
Sealands Mercedes Fobes	H. G. Cameron, Weraroa ..	3 359	312·9	365	14,703·8	446·18
Anawhata Dorothy Minto 12th	Estate of P. F. Boucher, Onehunga	3 361	313·1	331	11,695·4	435·75
Junior Four-year-old						
Rosevale Countess Johanna Posch*	H. North and Sons, Omimi	4 176	331·1	365	24,517·6	743·58
Senior Four-year-old.						
Rosevale May Gipsy Sylvia*	H. North and Sons, Omimi	4 347	348·2	365	19,019·0	631·24
Pauline Domino of Braystone†	A. R. Weal, Pukeatua ..	4 360	349·5	344	11,734·2	415·04

LIST OF RECORDS—*continued.*

FRIESIANS—*continued*

Name of Cow and Class.	Tested by	Age at Start of Test	Fat req'd for Cert	Yield for Season. Days	Milk.	Fat.
		Yrs dys	lb.		lb.	lb.
Mature						
Rosevale May Echo Catrina[1]	H. North and Sons, Omimi	5 143	350·0	365	20,786·8	700·04
Rosevale Model Keyes[1]	H North and Sons, Omimi	8 228	350·0	365	16,164·2	655·30
Monavale Felicity Paxton†	R Marr, East Tamaki ..	10 34	350·0	323	17,795·1	655·24
Rosevale Amelia Sylvia[1]	H. North and Sons, Omimi	6 352	350·0	365	18,805·4	577·31
Rosevale Jewel Sylvia*	H North and Sons, Omimi	5 281	350·0	365	15,720·3	558·38
Minnie Jessie of Oakview	Oakview Stud Farm, Auckland	8 31	350·0	365	13 535·1	550·44
Rosevale Audrey Sylvia[1]	H. North and Sons, Omimi	7 23	350·0	346	17,015·5	524·80
Bracken Queen Daffodil†	A. R. Weal, Pukeatua ..	5 332	350·0	365	15,982·6	497·04

MILKING SHORTHORNS.

Name of Cow and Class.	Tested by	Age at Start of Test	Fat req'd for Cert	Days	Milk.	Fat.
Junior Two-year-old.						
Hairuia Esther 2nd†	A. L. Souter and Son, Waerenga	2 36	244·1	365	8,834·5	383·83
Senior Four-year-old.						
Victoria Frolic 1st ..	J Bateman, Invercargill ..	4 315	345·0	323	9,005·7	348·44
Mature.						
Matangi Hazel ..	J. Bateman, Invercargill ..	6 364	350·0	342	9,768·0	406·75

AYRSHIRES.

Name of Cow and Class.	Tested by	Age at Start of Test	Fat req'd for Cert	Days	Milk.	Fat.
Four-year-old.						
Sadie 1 of Greenbank†	W. Moore, Masterton ..	4 12	314·7	365	10,451·6	526·83
Mature						
Maesgwyn Poppy* ..	C. Morgan Williams, Kaiapoi	8 309	350·0	316	14,936·5	506·14

Second-class Certificates.

Jerseys.

Name of Cow and Class.	Tested by	Age at Start of Test	Fat req'd for Cert	Days	Milk.	Fat.
Junior Two-year-old						
Te Kinga Superior Beauty*	R S Tuck, Waharoa ..	2 31	243·6	365	7,145·0	456·95
Pinewoods Dairymaid	G H. Bell, Oakura ..	2 32	243·7	365	7,853·3	428·55
Burrwood Rosette ..	J B. Tonar and Son, Northcote	1 344	240·5	365	6,234·0	338·72
Rockview Blossom ..	Estate of W. H. Fitness, Rehia	1 295	240·5	348	5,327·3	285·00
Senior Two-year-old.						
Blairichburn Bright Eyes	F. S McRae, Palmerston North	2 314	271·9	365	8,997·6	527·13
Mature.						
Bridge View Floss ..	A. E. Watkin, Takanini ..	5 302	350·0	365	9,333·8	509·01
Ona	F. J. Ryburn, Paterangi ..	5 74	350·0	365	9,922·6	555·23

Friesians.

Name of Cow and Class.	Tested by	Age at Start of Test	Fat req'd for Cert	Days	Milk.	Fat.
Senior Four-year-old.						
Rosevale De Kol Plus Sylvia*	H. North and Sons, Omimi	4 263	339·8	313	18,647·9	575·66

STATISTICS OF PASTURE TOP-DRESSING ON FARMS, SEASON 1928-29.

Land District	Actual Area top-dressed.	Superphosphate		Basic Slag.		Other Artificial Fertilizers.		Stable and Farm Manure.	Lime.	
		Area.	Quantity applied	Area	Quantity applied	Area.	Quantity applied	Area.	Area.	Quantity applied.
	Acres	Acres.	Cwt.	Acres.	Cwt.	Acres.	Cwt	Acres	Acres.	Cwt.
North Auckland	342,840	164,994	456,342	146,667	441,257	61,732	170,546	505	17,134	80,419
Auckland	886,996	698,241	1,800,953	165,817	395,007	131,653	301,776	659	56,224	158,028
Gisborne	38,805	34,550	75,206	2,922	4,270	2,750	5,471	7	1,456	7,030
Hawke's Bay	101,716	92,141	204,589	4,264	11,143	4,475	9,471	130	2,843	15,146
Taranaki	317,598	122,907	289,126	194,025	485,208	20,714	47,631	103	12,486	42,096
Wellington	291,331	195,776	445,512	66,589	166,297	29,986	74,788	498	16,837	101,425
Nelson	22,178	17,724	36,619	3,171	7,864	1,114	2,230	108	2,745	27,850
Marlborough	18,252	16,149	26,220	586	1,295	1,685	2,783	79	633	4,401
Westland	6,621	4,685	10,198	280	568	1,133	2,856	116	1,348	8,825
Canterbury	100,707	90,897	135,482	1,082	1,960	3,212	6,280	242	13,092	76,094
Otago	82,684	58,948	120,584	5,920	13,011	7,077	16,790	326	21,027	231,653
Southland	175,464	106,871	244,256	28,612	61,173	42,181	83,191	193	77,548	604,439
Totals, 1928–29 ..	2,385,182	1,603,883	3,845,087	619,935	1,589,053	307,712	723,813	2,966	223,373	1,357,406
Totals, 1927–28 ..	..	1,369,050	3,405,808	276,967	812,695	518,199	533,531	3,150	118,124	1,031,278

NOTE.—In cases where farmers top-dressed the same areas with two or more of the fertilizers quoted, either separately or as a mixture, duplication of such areas under the appropriate fertilizer headings may have resulted. Consequently the actual total area top-dressed is somewhat less than the sum of the areas appearing under the individual fertilizer headings.

—*Census and Statistics Office.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

BLUESTONE SOLUTION FOR DRENCHING SHEEP.

G. H. MARSHALL, Kakatahi :—

Regarding the bluestone solution for drenching lambs, is this remedy effective against all parasites infesting stomach and bowels of sheep? It is a common practice hereabouts to use 4 oz bluestone to the gallon and to give a 1 oz dose. I notice the Department recommended a solution of less strength and a larger dose Would one method be likely to be more effective than the other? Is it essential to use a copper drenching-tube? Would a galvanized tube allowed to stand awhile in a copper solution be equally effective, or would it still continue to coat with copper and thus weaken the solution used for the drench?

The Live-stock Division :—

The bluestone solution is not effective against all parasites infesting the alimentary canal of sheep. It is, however, effective against the stomach-worm, which is considered to be the most harmful parasite The strength recommended by the Department is 1½ oz bluestone to the gallon of water, the dose varying up to 3 oz. for adult sheep If the solution used by you has proved to be safe it may be continued, but the weaker solution has been proved to be non-injurious. The actual dose of bluestone administered per animal is about the same in each case A copper drenching-tube is advisable, as the solution corrodes other metals. It is a weak solution, and if the tube is rinsed with water immediately after use the corrosive effect will be practically negligible.

PRECAUTIONS IN USE OF SODIUM CHLORATE AS A WEED-KILLER.

C. H. JENKINS, Onehunga :—

In the *Journal* for August last the Horticulturist refers to the use of sodium chlorate for weed-killing, stating that it is inflammable and directions given with it should be strictly adhered to I should be glad to have further information on this point, as the seedsmen's shops do not appear to stock this material

The Horticulture Division :—

Regarding necessary precautions in the use of sodium chlorate, experiments are now being carried out by the Fields Division of the Department, with a view to ascertaining just what are the risks and advantages of this material as a weed killer under local conditions Meanwhile the following extract from an overseas publication may be of some use to you : Sodium chlorate in contact with finely divided organic matter forms a combustible mixture. Clothing, fine straw, or chaff that has been moistened with a solution of this material and permitted to dry may be ignited by friction or a spark and become a fire menace. For these reasons sodium chlorate should be handled carefully The spray solution should not be prepared inside barns or sheds, and if clothing becomes saturated it should be thoroughly rinsed before being allowed to dry It is advisable to wear rubber boots while spraying, and to keep wagons and spray equipment well painted

CONTROL OF WIREWORM PEST.

H. A. FINCH, Hokitika :—

I have a piece of land which is literally alive with wireworms and grass-grubs. I was not aware of the presence of wireworms until I commenced digging a crop of potatoes off this land, the crop being almost a total loss. The land referred to is of rather a light sandy nature. What would be the best and quickest way

of ridding the land of the trouble? Would a heavy crop of mustard be of any use? I would like to grow another crop of potatoes on the same piece of ground next year.

The Fields Division :—

The growing of a crop of white mustard and turning in under as it comes into flower is quite a good method to adopt where wireworms are troublesome. Wireworms are usually found on newly-broken-up land, but at times they are very plentiful under other circumstances, and where that is the case a crop of mustard ploughed or dug in seems to completely overcome the pest. We have not noticed any case of wireworm damage to potatoes following a crop of mustard. On one occasion when wireworms were plentiful a crop of mustard was sown, but there was insufficient seed to sow all the block, with the result that one part was left fallow. The whole block was planted in spring with potatoes. Where the mustard had been dug in the tubers were free from damage, while on the other part the crop was unfit for table purposes. You should procure the mustard from your seedsman, and sow at the rate of 15 lb. per acre.

GOATS AND FOOT-ROT.

"NEW CHUM," Levin :—

Please inform me whether goats suffer from and spread foot-rot?

The Live-stock Division :—

Goats in their wild state do not suffer from foot-rot, so far as our knowledge goes, but when confined to low, wet pastures are liable to become affected, although never to the same extent as sheep.

LYMPHANGITIS IN MARE.

"SUBSCRIBER," Studholme Junction :—

I have a dry mare, aged thirteen, periodically troubled with swelling of the hind legs, making them resemble an elephant's. Also, along under the stomach, from front to back legs, there are swellings like broad, flat veins. None of it is puffy, but feels quite hard to the touch. The mare is running in good grass and has had very little dry feed. I would be glad of any information regarding the cause and treatment of this trouble.

The Live-stock Division :—

Swelling in the hind legs such as you describe is known as lymphangitis or weed, and is usually met in horses of the heavier type, especially those of a lymphatic or sluggish nature. The swelling is the result of an accumulation of lymph in the lymphatic vessels. The cause of this complaint is generally an over-abundance of good food and lack of exercise, although occasionally it is met in horses low in condition. In working horses it occurs after a short period of idleness, and is sometimes known colloquially as "Monday morning disease." The disease has a marked tendency to recur, and after repeated attacks the limb becomes permanently enlarged, and an incurable condition termed elephantiasis or "elephant-leg" develops. For treatment give a physic ball composed of Barbadoes aloes, 5 to 7 drams (according to size of mare) and ginger, 2 drams. It will be necessary to prepare the mare by giving two or three bran mashes before and after giving the ball. Hot fomentations should have been applied to the legs in the first place, but they may not be of much benefit now. However, you could try them. Preventive measures should be adopted by giving laxative feeds and exercising the mare.

Wool Clips.—The amount of wool shorn in the season 1928–29 was 203,118,870 lb. from sheep and 7,580,793 lb. from lambs. In the season 1927–28 the respective figures were 187,883,202 lb. and 7,004,322 lb. The average fleece per sheep weighed 8·03 lb. in 1928–29, as compared with 7·84 lb. in the previous season.

ESTIMATED YIELDS OF WHEAT, OATS, AND BARLEY.

THE following estimated average yields per acre of wheat, oats, and barley for the season 1929–30 have been compiled by the Census and Statistics Office from reports furnished by Inspectors of the Department of Agriculture throughout the Dominion, and issued under date 11th February :—

District	Wheat. Bushels per Acre.	Oats Bushels per Acre.	Barley. Bushels per Acre.
North Island	34·03	39·47	38·39
Nelson	24·00	30·00	35·00
Marlborough	30·72	35·00	34·91
Canterbury	30·40	38·61	31·54
Otago	30·89	38 26	36·26
Southland	36·61	45·50	41·17
Average (estimated) for the Dominion, season 1929–30	30·56	39·71	33·89
Average (actual), for the Dominion, season 1928–29	34·60	41·93	40·06

In accordance with the above estimates, the total yield of wheat for the Dominion should be approximately 7,100,000 bushels, as against an actual yield of 8,832,864 bushels for the season 1928–29

The percentage of oats threshed for the five seasons ending with 1928–29 was 28·87 of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be approximately 3,150,000 bushels, as against an actual yield of 3,065,113 bushels for the season 1928–29.

The percentage of barley threshed for the five seasons ending with 1928–29 was 98·23 of the total area under that crop Assuming that a similar proportion is threshed this year, the total yield of grain should be approximately 680,000 bushels, as against an actual yield of 781,102 bushels for the season 1928–29

FORTHCOMING AGRICULTURAL SHOWS.

THE following show-dates have been notified by agricultural and pastoral associations :—

Marton A. and P Association Marton, 26th February.
Auckland A. and P. Association · Auckland, 27th February to 1st March.
Taranaki Agricultural Society : New Plymouth, 5th and 6th March.
Waikato Central Agricultural Association · Cambridge, 5th and 6th March.
Morrinsville A. and P. Society . Morrinsville, 12th March.
Hawke's Bay A. and P. Society : Autumn Show, Tomoana, 19th March.
Methven A. and P. Association : Methven, 29th March.
Oxford A. and P. Association Oxford, 3rd April
Flaxbourne A. and P. Association · Ward, 10th April.

Spray Injury to Apple-trees —" During November last several instances of injury to fruit by spraying came under notice " (reports Mr. J H Thorp, Orchard Instructor, Nelson). " The injury consisted of the blackening of the skin of the apples, and occurred chiefly on trees sprayed during a period of changeable weather after spraying with lime-sulphur plus arsenate of lead, and lime-sulphur plus precipitated sulphur plus arsenate of lead. The varieties affected were Cox's Orange and Sturmer. In my opinion, the injury resulted from the applications being made when moist, muggy conditions were prevailing, causing excessive fuming of the sulphur compounds."

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RELATIONSHIP AND CONTROL OF ANNUAL GRASSES AND CLOVERS IN PASTURE.

THE HAWKE'S BAY AND POVERTY BAY FLATS.

E. BRUCE LEVY, Agrostologist, and WM. DAVIES,* Plant Geneticist, Plant Research Station, Palmerston North.

IT is impossible to carry out wide-scope field-work such as that associated with the seed-production industry of Hawke's Bay and Poverty Bay without receiving strong impressions. Here one sees high-production pastures that can be ranked among the world's finest grasslands—those compact swards of rye-grass and white clover that indicate so well the presence of ideal conditions for pasture-growth; the thriving sheep and cattle; the setting of lofty poplars, canopied willows, and distant hills; the sunny skies—all go to make a satisfying rural picture (Figs. 1–3). On the other hand, one sees also far too much depletion of soil-fertility, indifference to drainage and flood-water control, failure to utilize surplus feed as hay or ensilage, failure to appreciate what actually constitutes a good pasture. The rye-grass and white clover, instead of being dominant as they should be over the whole of the plains country, are often starved and dwindled and their place occupied by inferior grasses and weeds.

We hold that what grows on the top indicates the conditions in the soil below, and that given the right conditions for rye-grass and white clover to thrive, together with the correct strains of each, these plants will clothe the land and will keep all comers at bay. The first-rate pastures of Britain, like those of New Zealand, contain more or less high proportions of perennial rye-grass and white clover, with a varying smaller proportion of cocksfoot, crested dogstail, and Poa trivialis: the higher the aggregate of these five species—so long as rye-grass is the dominant one—the higher is the carrying-capacity of the pasture. The grassland problem of Hawke's Bay and Poverty Bay lies in knowing how to grow to perfection the type of rye-grass and white

* Member of staff of Welsh Plant Breeding Station, Aberystwyth, seconded to Plant Research Station, Palmerston North.

clover these districts are fortunate to possess. Manuring and management should be directed towards creating and maintaining year in and year out ideal growing conditions for " rye and white."

Good as are the pastures of the Hawke's Bay and Poverty Bay flats, they too often fall short of the ideal in that they carry a more or less high total proportion of annual grasses and clovers (Figs. 4 and 5). The major problem of these districts is wrapped up in the elimination and control of the annual The elimination of the annual is a piece of ecological work which, translated into practice, bids fair to rival in importance the elimination of scrub growths of the hill country, or the rush and perennial weeds of the wetter lowland pastures. Control is closely connected with an intimate study of the individual species and their requirement, and this work must be directed

FIG. 1. TYPICAL PASTORAL SCENE ON THE HASTINGS FLATS, CENTRAL HAWKE'S BAY.

The Hastings flats rank among the world's finest grasslands. Here is attained the ideal sward of dominant perennial rye-grass and white clover—high-production pasture in an attractive setting.

[*Photo by E. Bruce Levy.*

towards the setting-up of conditions that mitigate against the establishment and development of the annual—towards effecting that smaller or greater alteration of the habitat conditions which upsets the equilibrium of plant and habitat. At the present time the pendulum swings more or less at will—this year towards the dominance of annuals, next year towards that of the perennials. A comprehensive ecological study of the situation should direct the efforts of the farmer to prevent the recurring of conditions that favour the annual, and should tend to stabilize growth conditions so that the balance of power remains definitely with the perennial.

In this course we recognize the disturbing factor of climate. In a dry season, with the inevitable opening-up of the sward, and with slow autumn recovery of the perennial element and general falling-off of available soil-fertility owing to soil-dryness, the swing is essentially towards the annual; but we feel that (other than in years of prolonged

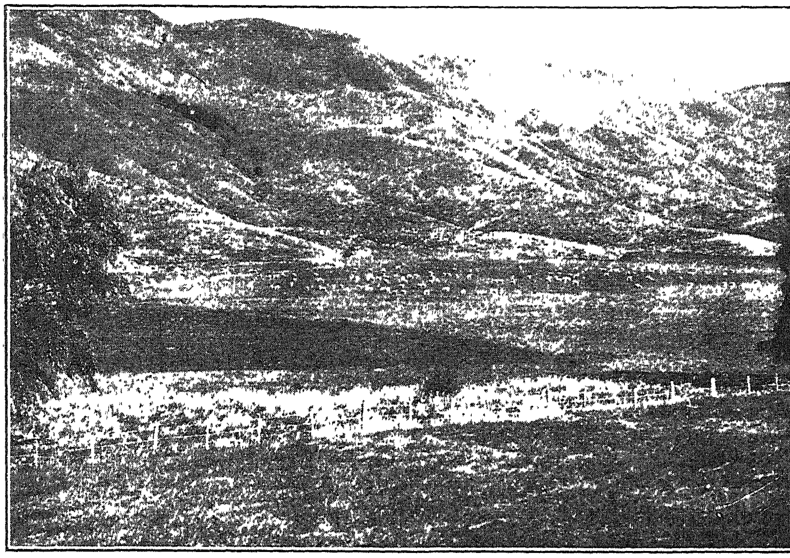


FIG. 2. A HAWKE'S BAY SCENE FARTHER BACK AMONG THE HILLS.

Here the smaller flats carry the same ideal turf, and produce, acre for acre, equal to the wider plains.

[*Photo by H Drake.*

FIG. 3. CLOSE-UP VIEW OF AN OLD HAWKE'S BAY PASTURE—DOMINANT RYE-GRASS AND WHITE CLOVER, WITH SOME COCKSFOOT AND POA TRIVIALIS.

A vigorous sward such as this, dense to the bottom, will keep at bay allcomers, but just so soon as the turf weakens and opens up it is subject to invasion by a host of annuals and perennials that also thrive under the congenial conditions of the district.

[*Photo by E. Bruce Levy.*

drought) it is possible and practicable on the Hawke's Bay and Poverty Bay flats to create a condition that has a distinct bias towards the perennial.

It may be asked, What are the conditions that favour the annual? A content of annuals indicates a weakness, an openness of the sward at certain periods of the year, particularly at establishment time in the autumn. That weakness may be caused by any one of the following factors: (1) Prolonged drought; (2) production of hay or seed crops; (3) treading out of the turf by crowded stock in dry weather or by poaching in wet weather; (4) reduction in soil-fertility, leading to slow recovery of rye-grass and white clover after autumn rains, (5) sowing down, in the initial seeding, short-lived types of pasture plants that leave open spaces at their death.

Into pastures opened by any one of the above causes the annual gains entrance—at first it may be in small numbers. Most annuals ripen their seed before rye-grass, and even in the normally grazed pasture, owing in general to the unpalatable nature of the seed-head, seed of annual species is shed on to the bare spaces of the open sward. With the advent of rain these germinate and re-establish in the pasture, often in increasing numbers. How many farmers see their second consecutive seed crop dominant goose-grass, hair-grass, or barley-grass, instead of rye-grass, and instead of white clover in come burr, suckling and clustered clover. What increased wealth it would mean to Hawke's Bay and Poverty Bay if only the usurpation of the ground by this inferior annual element could be prevented. We venture to say definitely there is no place for the annual in ideal swards; further, that the ideal is attainable and, we feel sure, economically profitable on this country.

Common Annual Grasses and Clovers.

The most common of the annuals in Hawke's Bay and Poverty Bay are goose-grass, barley-grass, and hair-grass, spotted burr clover, toothed burr clover, suckling clover, clustered clover, haresfoot trefoil, and in parts subterranean clover and striated clover The following brief notes set out the ecological relationship of these annuals, and the demands they make upon the habitat and the other sward constituents.

GOOSE-GRASS (*Bromus hordeaceus*).

Goose-grass is a species of wide habitat range requiring for its establishment, in common with all annuals, weak turf and open sward conditions, particularly in the autumn. On the poor soils it makes its presence felt as a diminutive plant, often extremely hairy, producing but a few fertile seeds on spindly stalks a few inches high; on the better soils its growth is correspondingly taller and stronger and seed-head larger; while on the more fertile soils typical of the Hawke's Bay and Poverty Bay flats heavy yields of unpalatable herbage and seed are annually produced.

Lack of competition—be the cause what it may—contributes to the successful establishment and growth of this annual. Its abundance in the Hawke's Bay pastures is due almost entirely, one would say, to using the paddock for seed-growing too frequently. In almost all paddocks seeded consecutively for two or three seasons goose-grass, excepting at the gateways, becomes virtually dominant; while in no case

have we found abundant goose-grass where the paddocks had been grazed for several consecutive years prior to shutting up. It is in the openness of the aftermath of a seed crop that goose-grass establishes, and once established it vies successfully with the rye-grass debilitated by the drain of the seed harvest and smother of the growing crop.

What would be the effect of strong aftermath recovery rye-grass on the seedlings of goose-grass is a question of high moment. How synonomous is the presence of goose-grass with lack of vigour of rye-grass is shown by the local belief that goose-grass is but a transmuted rye-grass run out and debilitated. True, it is that run-out debilitated

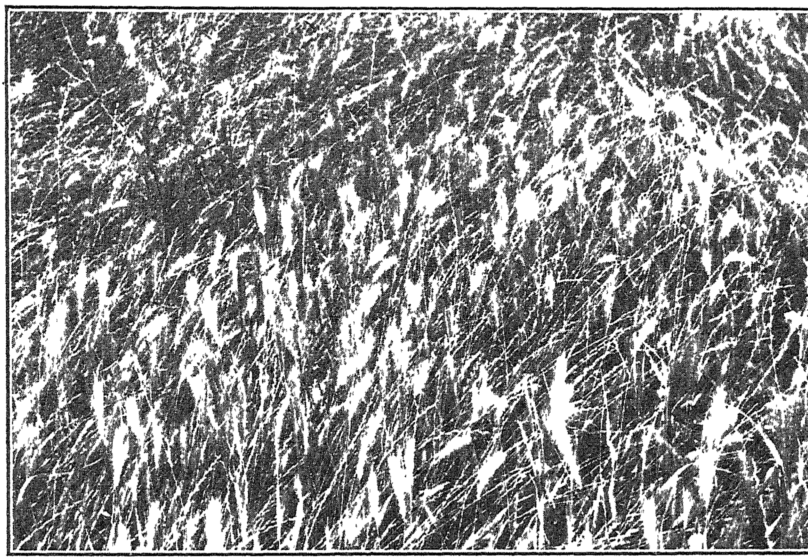


FIG. 4. A HAWKE'S BAY PASTURE RUN TO DOMINANT BARLEY-GRASS.

Similar photos could be shown with goose-grass, Yorkshire fog, Poa trivialis, or hair-grass dominant. These annual or perennial grasses thrive in this district equally well with rye-grass, but the set of conditions that govern their rise to dominance is different to that set which enables rye-grass to dominate them The aim is to find out exactly what rye-grass demands, and then order our farming to provide the rye with those conditions.

[*Photo by E Bruce Levy.*

rye-grass leads to goose-grass, and equally true that strong vigorous rye-grass gains mastery over this selfsame annual. One has but to look at gateways where the fertility is high and the conditions favour rye-grass; here it holds sway and stands second to none.

BARLEY-GRASS (*Hordeum murinum*).

Barley-grass is a demander of high soil-fertility; it does not persist as a dwindled, insignificant plant on poor soils in the same way as does goose-grass. It has a narrow habitat range; in other words, it dominates only under certain special conditions. Overtreading of the ground during summer to such an extent that rye-grass is literally trodden out, together with the inbrought fertility for which sheep-camps are so noted,

are the two major factors responsible for the presence of barley-grass. Again, in the case of the rich stack-bottom, where the rye-grass is killed entirely by smother and by much treading during the winter while stock are consuming the straw, high fertility and no competition favour barley-grass above all others. Around willow-trees, poplars, and in other spots in the paddock where stock camp, barley-grass is dominant, gradually thinning out as the degree of treading lessens, until the zone of rye-grass persisting under the lighter treading, but still high fertility, is reached.

Control of barley-grass seems a matter of stock-manipulation almost entirely, together with the use of the mower to prevent reseeding. Were it possible to wipe out all camp-sites the trouble from barley-grass would be almost eliminated. Such places are almost invariably the source of supply of seed that stock distribute to other small weak open spaces throughout the general run of the paddock.

HAIR-GRASS (*Festuca myuros*).

Hair-grass occupies areas of low fertility where there is little or no competition from perennial species The interstices of a danthonia sward almost invariably hold hair-grass — fine-leaved, producing but scant edible herbage in the early spring, and running rapidly to unpalatable stem and seed in the early summer. The long bearded seed of hair-grass is a frequent impurity in danthonia seed, and so consistent is this species in the swards of danthonia that the Maori has come to regard it as the " daddy of danthonia—no hair-grass, no danthonia." It only goes to show that hair-grass is essentially an inhabitant of low-fertility soils No rye-grass or any other plant of high producing capabilities could thrive on soils running dominantly to hair-grass. The fertility of those soils must be raised.

SPOTTED BURR CLOVER (*Medicago maculata*) AND TOOTHED BURR CLOVER (*M. denticulata*).

The more common of these two species in New Zealand is spotted burr clover, but as their ecology is similar they are treated as one under the general term of " burr clover."

Loose soil conditions, moderately fertile to fertile, with little competition from perennial species, are essential conditions for burr clover. In a sense burr clover, when once established, creates its own conditions as far as weak turf is concerned. Stock neglect it because of its unpalatable herbage, and so rank and prolific is its growth that it often overtops and actually smothers out the rye-grass and white clover, leaving at the end of summer bared and open sward well seeded down for the perpetuation of its kind on the advent of autumn rains.

Control would appear to centre in management of the sward — to graze it moderately low, and to keep, by mowing if necessary, the heavy smother away from the rye-grass and white clover, together with stimulation of the rye with a quick-acting manure that favours grass rather than clover. Sulphate of ammonia immediately appeals. To control burr one has got to get the grass. A tight and vigorous turf is essential, and it would appear that where burr is bad, ploughing and resowing to a good rye-grass, together with feeding and managing of the new sward, is the course to pursue.

SUBTERRANEAN CLOVER (*Trifolium subterraneum*).

Subterranean clover is a highly palatable annual which establishes in the autumn in a weak turf (generally made so by its own prolific spring growth) much in the same way as in the case of burr clover. Ecologically, subterranean clover resembles burr clover, and the same conditions of fairly fertile to fertile conditions must apply. One can place subterranean clover in the fertility scale between white clover above and suckling clover below. The palatable nature of subterranean, however, renders it useful and easy to control. In a grazed sward, with an increase of fertility during the autumn recovery of the pasture and into the winter, it is possible to so stimulate white clover that this

FIG. 5. A HAWKE'S BAY PASTURE RUN TO DOMINANT SUBTERRANEAN CLOVER.

Here also burr clover, clustered clover, or suckling clover dominant could be similarly shown. These four annuals, as in the case of the annual grasses, thrive wonderfully in Hawke's Bay and Poverty Bay, but just as the annual grasses should be replaced by rye-grass, so these annual clovers should be replaced by white clover. Here again it is a question of ordering our farming to provide white-clover conditions and not those that favour the annuals.

[*Photo by E. Bruce Levy.*

perennial species can vie successfully with the annual. The aim in dealing with two equally palatable species is to raise the fertility, so that the perennial jumps away in the autumn before the annual germinates and establishes from seed. Given haying-conditions, however, subterranean clover, with its temporary higher-yielding and higher-growing nature, will subdue white clover and even badly smother rye-grass.

SUCKLING CLOVER (*Trifolium dubium*).

Suckling clover is perhaps the most cosmopolitan species of low-fertility soils known in pastoral agriculture; it is essentially an indicator of low fertility—soils too poor for white clover to thrive in. Control of suckling on any lowland pasture is primarily a matter of increase

of fertility by top-dressing. The quantity of this seed dressed out of Hawke's Bay and Poverty Bay rye-grass is altogether too large. In the trade it is worth about 4d per pound, whereas white clover, which should be made to replace this annual, fetches three times that price or more. Suckling in itself is a wonderful little clover, hardy, palatable, and with an extremely wide habitat range as to soil-type; it is a free seeder and ready establisher, and gives a great response to phosphatic manures. As a matter of fact, on many soils more than half the value of the manuring is secured through suckling clover. But this does not justify its presence on the Hawke's Bay and Poverty Bay flats This country should be made to carry white clover in every spot now dominated by suckling Control is relatively simple on this class of country, and lies in the upkeep of a higher scale of fertility than is maintained at present

CLUSTERED CLOVER (*Trifolium glomeratum*).

The essential difference between suckling clover and clustered clover ecologically is the wideness of range of the former and the narrowness of range of the latter. The fertility-requirement of each is essentially the same. Clustered clover prefers light, free, open soils, and is very partial to the sea-coast In growth habit it is spreading rather than erect, and the light - canary - yellow matt - surface seeds are borne in clusters right in the axil of the leaf or on a very short seedstalk. The seed has often passed through commercial channels as white clover—needless to say, much to the chagrin of the farmer buying such seed. In value clustered clover approaches suckling, but the same remarks apply to this species as to the latter—it should be ousted by stimulation of white clover on all the Hawke's Bay and Poverty Bay flats.

STRIATED CLOVER (*Trifolium striatum*).

This clover is not very common on the Hawke's Bay and Poverty Bay lowland country. It occupies a position in the fertility scale along with and is ecologically equivalent to clustered clover.

HARESFOOT TREFOIL (*Trifolium arvense*).

Lower down in the fertility scale, below suckling clover and clustered clover, in company with English hair-grass (*Aira caryophyllea*) and other lowly weeds, comes haresfoot trefoil. This clover is extremely unpalatable, and occupies soils in the North Island at least virtually on the lowest rung of the ladder, such as stony river-beds or sands that dry out extremely rapidly. We make no recommendation at the present moment in the matter of improving these soils.

Two Perennials affecting Rye-grass.

In addition to the foregoing annuals there appear on the Hawke's Bay and Poverty Bay flats in varying degree two perennial grasses—Poa trivialis and Yorkshire fog—between which and rye-grass we feel there is a definite relationship.

POA TRIVIALIS.

This grass is essentially suited to rich soil conditions, to situations inclined to be wet rather than dry. In the fertility scale we place it

just below rye-grass, but it is essentially tolerant of wetter conditions than rye-grass can stand. It spreads and gains in a pasture in virtue of stem tillering rather than crown tillering, and its root-system originates from creeping stems that are entirely above ground. On this account Poa trivialis is very susceptible to drought, and under normal summer conditions it dries up and almost entirely disappears from the sward, leaving as a result a marked openness in the pasture

Poa trivialis seeds freely and ripens its seed before rye-grass, and the seed shed on to the ground establishes itself after the rains of autumn. In a wet season—such as this year's—Poa trivialis may be

FIG 6. A STRIKING ILLUSTRATION IN HAWKE'S BAY OF RESPONSE TO CONDITIONS SET UP.

Across this paddock, running from the foreground of the photo to the middle distance, is a stock-track about 8 ft wide, this being dominant rye-grass. On each side, throughout the whole of the paddock, Yorkshire fog, goose-grass, and Poa trivialis are dominant. This is highly suggestive of possibilities in manuring and management.

[*Photo by E. Bruce Levy.*

very prevalent and persist throughout the summer. On areas where the sward has been drowned out by flood—rye-grass does not stand flood conditions for long—Poa trivialis may dominate, as was found to be the case on many low-lying paddocks this year. As an associate species for rye-grass we welcome Poa trivialis, yet we would stress the point that gain to dominance over rye-grass indicates a condition which should be rectified. Flood-control is essential for the rye-grass pasture, and drainage to remove soggy pasture conditions in the winter, together with upkeep of fertility, are essential features to give rye-grass the ascendency over Poa trivialis. On rich, constantly damp soils Poa trivialis is a first-rate grass, and as a bottom species would seem to have a wider application in New Zealand pastures than it occupies to-day. We would stress the point again, however, that a high

percentage of Poa trivialis (just as in the case of a high percentage of white clover) indicates a weakness in the rye-grass content of the pasture.

YORKSHIRE FOG (*Holcus lanatus*).

This cosmopolitan species in many respects demands the same conditions for its spread as does Poa trivialis. Moderately rich soil with damp surface conditions are most congenial, and given such conditions spread of Yorkshire fog may be quite rapid, either by establishment of seed or by stem and crown tillering A weak, drowned-out, open turf affording little competition favours Yorkshire fog and Poa trivialis alike. Yorkshire fog, however, has an extremely wide habitat range in comparison with the comparatively narrow habitat range of Poa trivialis. It will thrive on the most fertile of soils, and under rank growth conditions may become dominant, it persists strongly on dry light soils and on stiff clay soils. In fact, this grass is to be found on almost every type in varying degree, contributing often a quota of feed that is seldom appreciated by the farmer. Under dry conditions it persists by means of crown tillering rather than stem tillering, and stimulates the tussock form rather than turf grass This flexibility of form in Yorkshire fog would appear to govern its wide range persistency.*

As a competitor to strong-growing, well-utilized rye-grass Yorkshire fog takes second place, and this is the point we particularly wish to make in regard to the Hawke's Bay and Poverty Bay pastures. An increase of Yorkshire fog—just as in the case of Poa trivialis—indicates a weakness in the rye-grass brought about either by too much wet in the winter, too much rank growth in the spring, or too low a soil-fertility upkeep.

The relative position of rye-grass on the one hand and Yorkshire fog and Poa trivialis on the other are clearly exemplified in Fig. 6.

Suggestions for Control of the Annual.

From the foregoing matter it will be seen that an annual relies on abundant reseeding for its propagation from year to year. It has to re-establish from that seed, and for successful re-establishment competition from existing adult plants of perennial species in the pasture must not be too severe. Here is the weak link in the life-history of the annual, and it is at this weak link that the farmer's efforts must be levelled The aim must be to so manage the pastures that the perennial plants of the sward—rye-grass, white clover, and other bottom grasses such as Poa trivialis and crested dogstail—shall spread or tiller out rapidly after any opening-up by whatever cause—by treading, through drought, or by smother caused by hay or seed crop. In any recovery period the sward must be tightened up so as to stifle the annual species during this initial phase of its re-establishment.

In the majority of the better-class pastures of Hawke's Bay and Poverty Bay there seems sufficient rye-grass present to effect the desired thickening-up of the existing sward with a view to preventing the establishment of the annual seedlings, but there is no doubt that to do this systematic manuring, properly applied, must be practised. From an analysis of patches which stock have manured heavily it is

* Strain selection work on Yorkshire fog now being undertaken by the writers may throw more light on the reason for the wide-persistency range of this species.

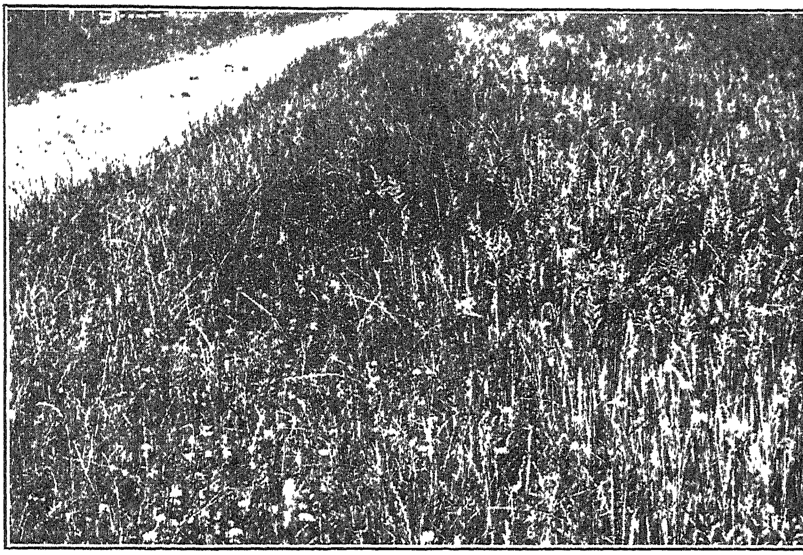


FIG. 7. A ROADSIDE STUDY IN HAWKE'S BAY.

The edge of the roadway for a width of approximately 3 ft. is pure rye-grass; for the next 6 ft. approximately it is rye-grass and white clover; then comes a zone where the rye-grass is less vigorous and Yorkshire fog and Poa trivialis are dominant

FIG. 8. CLOSE-UP VIEW ON AN OLD HAWKE'S BAY PASTURE SHUT UP FOR SEED.

Here rye-grass is dominant with good white clover. When this crop is cut there will inevitably be a temporary opening-up of the sward Quick recovery of the perennials is necessary to beat the annuals. An application of quick-acting manure must be of great assistance in quick recovery of the rye and white clover.

[*Photos by E. Bruce Levy.*

evident that low fertility at certain seasons of the year is the major factor contributing to lack of perfection in these pastures. In almost every paddock one can see on and around manure droppings small or large areas that are almost ideal in composition and carrying-capacity. These are deep green in colour, vigorous in growth, and almost pure rye-grass, white clover, and Poa trivialis, with in most instances a total suppression of the annual (Fig. 7).

The question is, Can not one profitably attain to this perfection over the whole paddock and over the whole area? We claim that by the use of artificial manures, coupled with efficient utilization, it is quite possible and profitable (Fig. 8).

It is claimed by many men on the East Coast flats that superphosphate brings on too much clover, and that it increases the abundance of annual weeds; yet some of those holding the finest grasslands in these areas are regularly top-dressing with phosphate. Their paddocks are dominantly rye-grass, white clover, and Poa trivialis, but we would agree with our critics that these paddocks in general carry too low a proportion of rye-grass in relation to clover. This can to a large extent be put right by the use of quick-acting nitrogenous manures, such as sulphate of ammonia, which will react quicker on the rye-grass than on the clovers, and, we claim, will bring rye-grass up to the position of being the dominant species in the pasture.

We feel that in the past a good deal of misconception of the value of manuring has arisen as the result of manuring pastures that have run largely to rubbish. If the rye-grass has gone or is badly weakened through years of neglect and consequent depletion of soil-fertility the rubbish will certainly respond to the application of fertilizers, and it may take several years of top-dressing before the rye-grass has sufficiently recovered in vigour to successfully compete with and eliminate the poorer elements of the pasture.

In many cases it must pay very much better not to put an ounce of manure on these very run-out pastures, but to break them up and resow and then to manure, using a mixture of phosphate and nitrogen. These should be quick-acting fertilizers to aid particularly quick establishment and recovery of the perennial in the autumn, before the annual re-establishes itself; and subsequently in the spring, after the opening-up by stock-treading, quick recovery again closes up the turf and shuts out the light at the ground surface, thus stifling spring and summer annual establishment.

Manuring, coupled with efficient utilization of the pasture, seems the keynote to improvement. In the process of bringing pastures back after manuring, to prevent reseeding of the annual and to give rye-grass and white clover free scope to develop and spread, early spring mowing and making of the material into ensilage appears to be very hopeful where control by grazing is difficult.

In seed-production, also, manuring and invigorating the sward may need be accompanied by better early control of the grazing, with a tendency to shut up the area later rather than earlier.

Out of manuring in Hawke's Bay and Poverty Bay there are bound to come added problems of utilization which may call for modification of existing farm practices. We have every confidence, however, that the local farmer will prove as amenable to change as is the sward itself.

TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1929

W. M. SINGLETON, Director of the Dairy Division, Wellington.

AFTER having shown a steady falling-off each year since 1924, entries for Certificate-of-record Test are now again on the increase. Twenty-six more cows qualified for certificate in 1929 than in 1928, and figures for the peak month of the current season show 864 cows on test on the farms of 272 breeders, as compared with 655 cows and 225 breeders for the highest month of last season. On a percentage basis this increase is by no means insignificant, and, further, there is reasonable prospect of the advance being sustained for another season at least.

As has been frequently stated, one of the principal objects in introducing the Certificate-of-record Test was to provide sires for ordinary dairy herds, sires which, because they are registered purebred and with C.O.R. butterfat-record pedigrees, would be of the greatest possible value in herd-building and in improving the yield of our average dairy cow. The support accorded the C.O.R. system is necessarily regulated to a considerable extent by the demand for bulls from C.O.R. cows, as the breeder of purebred dairy stock is largely dependent upon sales for his income. For some years past the prices offered for butterfat-backing C.O.R. bulls have hardly warranted any extensive C.O.R. testing programme on the part of breeders. The demand, however, is steady, and from a survey of recent sales results it is probably slightly improving. No doubt the marked advance of group herd-testing and its valuable educational service is having a favourable effect on the general position.

While the number of cows qualifying for certificate of record each year may be small in comparison with the total number of registered purebred dairy cows in the Dominion, there is perhaps a tendency to underestimate the number of bulls from C.O.R. cows available for service. The cumulative effect, which is considerable, must not be overlooked. We have taken out roughly an estimate of the number of bulls from C.O.R. cows which should be alive and available for service next season—1930–31. The estimate has been based on cows which have received certificates or have failed other than on production. Adjustment for age was needed in the case of the mature class, which includes cows five years old or over at commencement of test, and for purposes of the estimate the age of the average tested mature cow was taken as seven years. The other classes are based on the exact year of age, and thus no adjustment was necessary. The maximum age of the average cow was taken at nine years, or the birth of eight calves. A bull was assumed to be fit for service at a minimum of one year and a maximum of nine years. Actual C.O.R. records were taken to the end of 1929, but an estimate was necessary as to the number of cows of those at present on test which will qualify during the present calendar year. It has also been supposed that half the calves will be bull calves. The result comes out at 13,737

bulls, from yearling to not more than nine years of age, in the spring of 1930. Obviously when a cow completes a certificate-of-record test her performance affects all calves which have been born to her as well as those calves which may yet be born.

The Official Herd-test also provides for recording the yield of registered purebred dairy cows, and, while a detailed survey of this system would be out of place in the present review, it may be stated that working along similar lines on this test, which is now in its third season, and assuming a cow to be tested when she has been on test 180 days (six months) or more, it is found that 6,888 bulls from O.H.T. cows should be available for service in the spring of 1930. Added to the total of 13,737 bulls from C.O.R. cows, this makes the impressive grand total of 20,625. While, as previously mentioned, certain assumptions were necessary, and while some of the hypotheses may be open to difference of opinion, the result of the investigation can probably be taken as a reasonable indication of the position. Mortality would need to be considered, and also deformity, but, on the other hand, the estimate is perhaps conservative.

There has been of late a revival of interest in the question of a ten-months class for C O.R. cows, and it is probable that the additional class will be inaugurated next season There is much to be said on the subject, both for and against, and we hope to deal fully with the matter at a later date.

Some consideration has also been given to the question of dispensing with the butterfat standards for C.O.R. cows, it having been suggested that a certificate be issued to every cow which qualifies on the present rules other than those pertaining to quantity of butterfat. The elimination of the minimum production requirement did not, however, meet with the approval of all the breeders' associations. Moreover, the proportion of cows which fail to qualify on production is very small. It has therefore been decided to make no change in the present system in the meantime.

A matter which has given a certain amount of concern is the increase in the number of cases of lost milk-weights. The most common causes of such losses have been the destruction of the shed sheets by cows or calves, or the sheets have been torn off and blown away by the wind. Breeders should be particularly careful to see that the shed record sheets are kept in a safe place, as no allowance can be made for lost weight-records.

Owing to the demand on the limited space of the *Journal* it may be necessary to discontinue the publication in it of the C.O.R. lists throughout the year. The records now receive publicity each month through the official organs of the various breeders' associations, and it is considered that the position might be satisfactorily met by the publication once a year of an official pamphlet containing a complete list of particulars of certificates issued during the year, together with the annual review from the *Journal*. This would be sent free of cost to all C.O.R. testing breeders, and also made available to other interested persons.

The average production of all C.O.R. cows granted [certificates during the calendar year 1929 works out at 469·95 lb. butterfat. The

averages for the preceding four years were 467·92 lb. in 1925, 463·87 lb. in 1926, 469·56 lb. in 1927, and 469·53 lb. in 1928.

FIRST-CLASS CERTIFICATES ISSUED.

From the commencement of the C.O.R. system to the end of 1929 first-class certificates of record have been issued to 6,604 cows. In 1929 417 first-class certificates were issued to cows qualifying for the first time, and 74 to cows which had previously gained a certificate, making a total of 491 certificates for the year. Particulars of certificates issued during the past two years are given in the following table :—

Table 1.

Breed.	1929.			1928.		
	Ordinary.	Repeat.	Total.	Ordinary.	Repeat.	Total
Jersey .. .	315	52	367	328	39	367
Friesian	68	18	86	66	13	79
Milking Shorthorn ..	26	..	26	10	1	11
Ayrshire	6	2	8	3	2	5
Red Poll	1	2	3	2	..	2
Guernsey ..	1	..	1	1	..	1
Totals ..	417	74	491	410	55	465*

* Representing 464 cows, one cow having qualified for two certificates within the year.

SECOND-CLASS CERTIFICATES.

The number of second-class certificates issued during the year under review totalled twenty-eight, as compared with twenty-two for 1928. The twenty-eight certificates went to twenty-four Jerseys, three Friesians, and one Ayrshire respectively. The Jerseys averaged 445·52 lb. butterfat, the Friesians 612·97 lb., and the Ayrshire 529·35 lb. As most readers will know, the rules for the two classes of C.O.R. are identical, except that for a first-class certificate a cow must drop a calf within 455 days (fifteen months) after date of calving for commencement of test, whereas for a second-class certificate an extra thirty days is allowed, making 485 days, or, roundly, sixteen months between the calvings.

Jerseys.

Class-leaders.

The year under review brought forward no records which seriously challenged the existing class-leaderships of the Jersey breed, the list of highest producers having now remained unaltered since 1927. The list is repeated in Table 2 (next page).

Jersey Class Averages.

The Jerseys certificated in 1929 numbered 367, with an average production of 455·51 lb. butterfat. This represents a decrease of 1·41 lb. from the 1928 average of 456·92 lb. for the same number of cows. From Table 3 it will be seen that all classes except the junior

Table 2

Name of Cow and Class	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days	Milk	Butter-fat.
		Yrs. dys	lb		lb.	lb
Junior Two-year-old						
Ivondale Oxford Lass	R S. Tuck, Waharoa..	1 338	240·5	365	12,107·7	731·29
Senior Two-year-old.						
Ivondale Golden Rainbow	P J. Petersen, Waitara	2 311	271·6	365	12,962·2	768·16
Three-year-old						
Ivondale Golden Lass	P. J Petersen, Waitara	3 312	308·2	365	14,434·8	905 01
Four-year-old.						
Keston Flower ..	G E. Yelchich, Waiuku	4 64	319·9	365	14,679·2	814·05
Mature.						
Holly Oak's Annie..	W. T. Williams, Pukehou (deceased)	5 9	350·0	365	18,522·7	1,056·49

two-year-old show an increase over the previous year. Seeing, however, that the junior two-year-olds are in an overwhelming majority numerically, it is obvious that a decrease in average production for this class must have an inimical influence on the average for the whole breed.

The following table supplies class averages for 1929 and 1928 :—

Table 3

Class.	Number of Cows	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1929.		lb.	lb.
Junior two-year-old ..	164	342	6,930·3	387·64
Senior two-year-old ..	29	352	8,202·4	468·42
Three-year-old	45	347	8,850·5	495·46
Four-year-old	44	342	9,403·9	525·45
Mature	85	340	9,630·7	524·08
	1928			
Junior two-year-old ..	174	350	7,385·8	415·60
Senior two-year-old ..	33	349	8,046·0	455·06
Three-year-old	58	339	8,585 5	481·87
Four-year-old	37	348	9,108·6	498·11
Mature	65	339	9,396·4	522·78

The total number of certificates issued to Jersey cows from the commencement of the C.O.R. system in 1912 to the end of 1929 has now passed the five-thousand mark, the exact figure being 5,207, and although the average butterfat production for all junior two-year-olds to date has lost a little ground since the end of 1928 (0·27 lb.) the breed as a whole has shown an advance of 1·41 lb., the average for the 5,207 certificates being 446·97 lb.

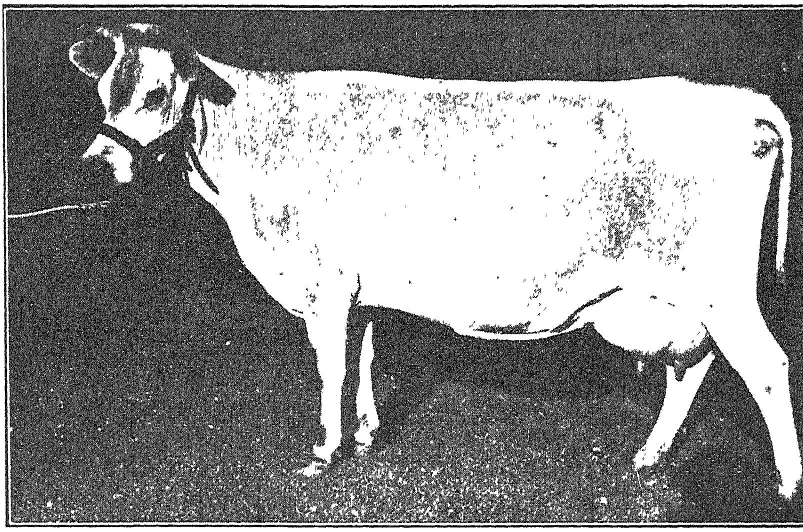


FIG. 1. SILVER MAHONE (G. S B. MORRISON, MAUNGATAPERE).

C O.R. in Jersey senior two-year-old class: 11,507·7 lb. milk, 665·94 lb. butterfat Highest record for the class in 1929.

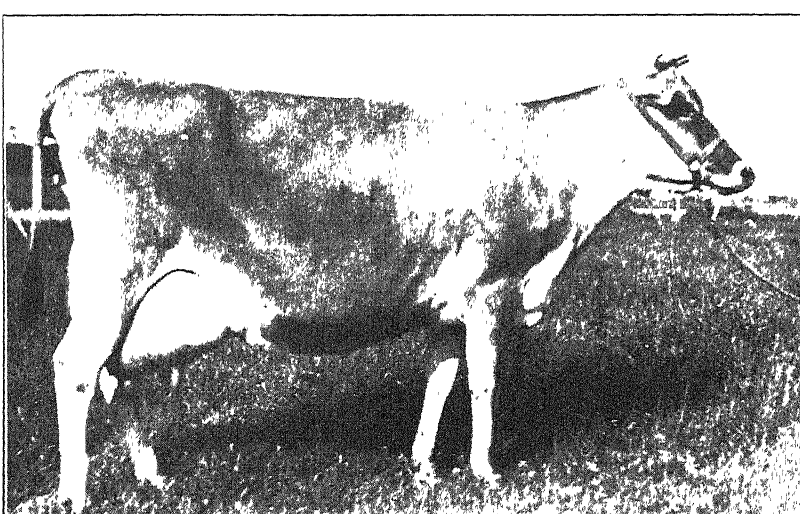


FIG. 2. BEECHLANDS PREFERENCE (A. MORELAND AND SONS, TE RAPA).

C.O.R. in Jersey mature class: 15,540·3 lb. milk, 847·49 lb. butterfat. Highest record for the class in 1929.

An interesting point connected with production of the Jersey breed is the marked consistency of the average butterfat test of the milk. To the end of 1929 this came out at 5·55 per cent., and for many years it has not varied more than 0·01 from that figure Moreover, the latest reviews which have come under our notice indicate that for the Island of Jersey, England, the United States, and New Zealand the average test for the Jersey breed is within 0·01 of 5·55 per cent. This surely points to a remarkable stage of standardization in the breed.

The averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. system are given in the following table :—

Table 4.

Class	Number of Certificates.	Average Yield for Season		
		Days in Milk	Milk	Butterfat.
			lb	lb.
Junior two-year-old . .	2,075	345	6,987·4	390·88
Senior two-year-old . .	549	344	7,741·5	435·92
Three-year-old . . .	795	342	8,397·1	467·46
Four-year-old . . .	508	345	8,892·7	493·50
Mature . . .	1,280	345	9,329·7	511·45
All . . .	5,207	344	8,043 8	446·97

Jersey C O R. Bulls

For the benefit of those who may not be conversant with this part of the system we repeat the explanation that by a "C.O.R. bull" is meant a bull which has sired at least four certificate-of-record daughters, each from a different dam. The New Zealand Jersey Cattle Breeders' Association makes a special classification under the heading of "Champion Butterfat Bulls," but the conditions relating to this class have recently been changed by the Association. Under the original conditions a bull was considered to be eligible for the Champion Butterfat class when he had sired at least five daughters from different dams, and each daughter having doubled her minimum butterfat requirement for certificate. Under the conditions which are to apply in future, however, it is required that bulls have five or more daughters (each from a different dam), which, under first-class C.O.R. conditions, produce 520 lb. butterfat when starting under test up to three years of age, 580 lb. when starting between three and four years old, 640 lb. when starting between four and five years of age, and 700 lb. when five years old or over.

On account of the rapidly increasing number of C.O.R. bulls it has been found necessary to discontinue the publication of the list of names and particulars in this annual review, and merely to give a statistical summary. Details are always available from the respective secretaries of the breeders' associations, or from the office of the Director of the Dairy Division, Wellington. Comprehensive particulars are also supplied in the year-books issued by the Friesian and the Jersey Associations as regards their own breeds.

Some 320 bulls have now qualified for the Jersey C.O.R. list. The number of bulls which added to their list of C.O.R. daughters during the year was sixty-one, while twenty-eight bulls newly qualified for the class. The total number of champion butterfat bulls to date under the original rule is fifteen, and nine of these are eligible under the new conditions.

Friesians.

Class-leaders.

The list of Friesian class-leaders remains unaltered, and, as in the case of the Jersey breed, no records were made during 1929 which at any stage of the test looked like superseding those of the present champions. The Friesian breed has remarkably good leadership performances to its credit, and it must be realized that any animal which can displace the present title-holders will be indeed a champion. The past year has been below the average in the matter of high producers, this applying to practically all the breeders.

The list of class-leaders is repeated as follows :—

Table 5.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys	lb.		lb.	lb.
Junior Two-year-old. Monavale Queen Bess	T. H. Richards, Cardiff	2 16	242·1	365	20,501·1	740·50
Senior Two-year-old. Pareora Echo Blossom	T. Sheriff, Clandeboye	2 223	262·8	365	22,671·9	819·81
Junior Three-year-old Monavale Queen Bess	T. H. Richards, Cardiff	3 56	282·6	365	21,609·3	800·18
Senior Three-year-old. Manor Beets Daughter 2nd of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18,733·9	863·51
Junior Four-year-old. Westmere Princess Pietertje	John Donald, Westmere	4 156	329·1	365	24,199·0	939·78
Senior Four-year-old Bainfield 27th ..	C. H. Potter, Pukerau	4 351	348·6	365	23,203·3	910·74
Mature. Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7 355	350·0	365	31,312·5	1,145·24

Friesian Class Averages.

There have been some rather marked ups and downs in the Friesian class averages for the past two years, and the wide variations are obviously due to the influence of individual performances, the

majority of the seven classes being very small. Even so, however, it is noticeable that the ages are more evenly distributed in 1929 than in 1928. Eighty-six Friesians were certificated in 1929, as compared with seventy-nine in the previous year. The average Friesian in 1929 produced 534·51 lb. butterfat, a very creditable increase over the 1928 figure of 527·97 lb. The class averages for the breed for the past two years are as follows:—

Table 6.

Class	Number of Cows.	Average Yield for Season		
		Days in Milk.	Milk.	Butterfat.
	1929.		lb	lb.
Junior two-year-old ..	25	347	13,631·1	477·98
Senior two-year-old ..	12	353	13,458·9	477·34
Junior three-year-old ..	4	359	17,549·8	598·48
Senior three-year-old ..	10	324	14,774·2	527·45
Junior four-year-old ..	5	356	17,296·2	601·58
Senior four-year-old ..	10	328	15,869·8	564·49
Mature	20	354	17,675·6	598·47
	1928			
Junior two-year-old ..	27	339	12,586·7	430·79
Senior two-year-old ..	13	351	13,668·6	490·17
Junior three-year-old ..	5	320	12,345·1	449·25
Senior three-year-old ..	8	362	16,300·8	602·37
Junior four-year-old ..	4	365	17,406·8	604·63
Senior four-year-old ..	4	361	17,122·1	622·87
Mature	18	352	18,867·1	651·74

Friesian cows in New Zealand have now received 1,743 certificates since the inauguration of the system in 1912. The average production to date works out at the substantial figure of 479·06 lb. butterfat, an increase of 2·88 lb. over the average to the end of 1928. Also, the average milk-yield has gone up almost 90 lb. The figures, class by class, are given in the following table:—

Table 7.

Class.	Number of Certificates.	Average Yield for Season		
		Days in Milk.	Milk.	Butterfat.
			lb	lb
Junior two-year-old ..	500	345	11,490·6	406·67
Senior two-year-old ..	228	346	12,406·0	440·07
Junior three-year-old .	162	341	13,229 4	464·69
Senior three-year-old ..	164	335	13,732·5	491·15
Junior four-year-old ..	105	344	14,938·7	526·09
Senior four-year-old ..	105	345	15,653·9	544·76
Mature	479	340	15,724·5	549·18
All	1,743	342	13,604·9	479·06

Friesian Bulls.

Friesian C.O.R. bulls—that is to say, Friesian bulls which have four or more C.O.R. daughters, each from a different dam—now total ninety-nine, of which number four qualified for their place during 1929. The number which added to their C.O.R. daughters during the year, or newly qualified for the C.O.R. class, was twenty-three.

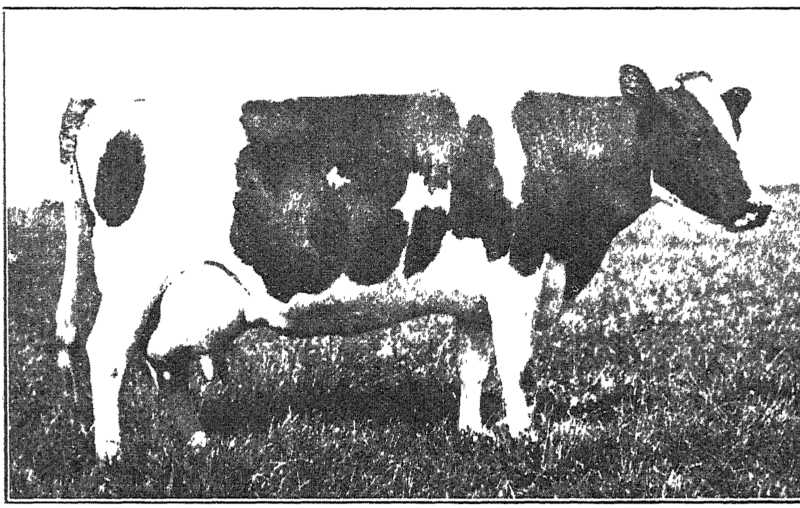


FIG. 3. DUTCHLAND MAKANUI OF OAKVIEW (OAKVIEW STUD FARM, AUCKLAND).
C.O.R. in Friesian mature class: 21,556·2 lb. milk, 754·72 lb. butterfat. Highest record for the class in 1929.

Milking Shorthorns.

Class-leaders.

Although there were no changes in the Milking Shorthorn class-leaderships during the year, some good performances were recorded. The senior two-year-old Dominion Althea of Ruakura, bred and tested at the Ruakura Farm of Instruction, Hamilton, gave 537·93 lb. butterfat, which is less than 5 lb. behind the record of the present class-leader. The mature class was a strong one, pride of place for the year being won by Mr. T. W. Wardlaw's Riverdale Florrie 2nd, with 761·17 lb. butterfat. Creditable records were also made by the same owner's Riverdale Florrie 3rd and Riverdale Grace 3rd, with 681·09 and 629·36 lb. respectively. Mr. Wardlaw (whose farm is at Waimana, Bay of Plenty) thus has the distinction of having tested the three highest-yielding Milking Shorthorns for the past year.

The list of class-leaders is repeated in Table 8.

Table 8.

Name of Cow and Class.	Tested by	Age at Start of Test	Fat required for Certificate.	Yield for Season		
				Days	Milk.	Butter-fat
Junior Two-year-old		Yrs dys.	lb		lb.	lb.
Matangi Quality 4th	Ranstead Bros, Matangi	2 109	251 4	365	14,572·8	501·89
Senior Two-year-old						
Matangi Quality 5th	Ranstead Bros., Matangi	2 204	200 0	365	11,752·8	542 66
Junior Three-year-old						
Matangi Quality 4th	Ranstead Bros., Matangi	3 153	292·3	365	16,281·4	678·02
Senior Three-year-old.						
Matangi Ruth 2nd ..	Ranstead Bros, Matangi	3 304	307·4	365	14,032 7	747·86
Junior Four-year-old.						
Matangi Matilda 4th	Hon Mrs E. J Blyth, Kohimarama	4 0	313·5	358	14,640 2	630·38
Senior Four-year-old						
Matangi Ruth 2nd ..	Ranstead Bros., Matangi	4 355	349·0	340	11,670·3	644·90
Mature.						
Glenthorpe Lady ..	A J Melville, Buckland	Mature	350 0	365	20,136·2	856·85

Milking Shorthorn Class Averages.

It is pleasing to record an increase of fifteen certificates for the Milking Shorthorn breed, there having been twenty-six cows certificated in 1929, compared with eleven in 1928. A list of class-averages is of little value, as fourteen of the twenty-six cows fall in the mature class, and the remaining six classes of the seven into which this breed is subdivided contain only one, two, or three records. The average for the breed, however—466·54 lb. butterfat—is very satisfactory, although showing a decrease from the preceding year's average of 480·96 lb.

Details of the class-averages for 1929 are as follows :—

Table 9

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1929.		lb.	lb
Junior two-year-old ..	2	309	9,466·5	400·67
Senior two-year-old ..	3	342	10,491·7	471·25
Junior three-year-old ..	2	313	10,468·3	433·41
Senior three-year-old ..	1	339	8,872·9	343·29
Junior four-year-old ..	2	332	12,132·4	468·17
Senior four-year-old ..	2	335	8,645·5	351·19
Mature	14	337	12,287·0	504·72

The averages, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914 are given in the following table :—

Table 10.

Class.	Number of Certificates.	Average Yield for Season		
		Days in Milk	Milk.	Butterfat.
			lb	lb
Junior two-year-old ..	49	349	8,488·0	348·29
Senior two-year-old ..	27	346	8,731·8	360·96
Junior three-year-old ..	22	333	9,594·6	383 88
Senior three-year-old ..	23	342	10,549·9	446·79
Junior four-year-old ..	20	347	11,008·1	443 34
Senior four-year-old ..	26	343	11,612·3	457 94
Mature	241	340	11,662·6	466·58
All	408	342	10,877·8	438·12

Milking Shorthorn Bulls.

The number of C.O.R. bulls of this breed remains as at the end of 1928, no bulls having newly qualified during the past year There are at present eight Milking Shorthorn bulls on the C.O.R. list, two of these having added to their C.O.R. daughters during the year under survey.

Ayrshires.

Class-leaders.

One change has taken place in the Ayrshire class-leaderships, this occurring in the three-year-olds. Mr A. M. Weir's Ivanhoe Stylish Daisy, with 574·09 lb. butterfat, yields place to Fair Lass of Greenbank, whose fine record of 639·85 lb. increases the leadership of the class by over 65 lb. She was bred and tested by Mr. W. Moore, of Homebush, Masterton, and is but one of several outstanding individuals raised by Mr. Moore. Fair Lass of Greenbank is from a long line of well-known Ayrshire ancestry, production being a strong feature of the pedigree. The ability to reproduce production-capacity is also apparent, and this, after all, is as important in the practice of breeding as the making of high records. Fair Lass of Greenbank is line-bred to the imported bull Dominion Netherton Good Bonus, who appears on both sides of her pedigree and was the paternal ancestor of many fine Ayrshires bred by the New Zealand Government. Fair Lass of Greenbank also traces to Craigellachie said to have been one of the finest Ayrshire bulls ever imported into New Zealand, and sire of Alexandra of Waipapa, who, with 591·16 lb. butterfat, was for many years the highest C.O.R. cow of the breed. The class-leaders for the Ayrshire breed are set out in Table 11 (next page).

Ayrshire Class Averages.

Eight Ayrshire cows received first-class certificates during 1929, as compared with five in 1928. Two of the eight cows were in the three-year-old class, their average production being 470·65 lb. butterfat. One four-year-old gained a certificate for 526·83 lb. butterfat, while five mature cows averaged 476·74 lb. All eight cows averaged 481·48 lb., as compared with an average of 520·02 lb. for the five cows certificated in the preceding year.

Table 11

Name of Cow and Class	Tested by	Age at Start of Test	Fat required for Certificate.	Yield for Season.		
				Days	Milk.	Butter-fat.
Two-year-old		Yrs dys	lb.		lb.	lb.
Fair Maid of Greenbank	W Moore, Homebush	2 27	243·2	365	12,281 3	673·56
Three-year-old						
Fair Lass of Greenbank	W. Moore, Homebush	3 306	307 5	365	16 110 4	639·85
Four-year-old.						
Ivanhoe Fancy ..	A. M Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713 93
Mature.						
Floss of Braeside ..	W Moore, Homebush	7 287	350·0	365	20,305·5	832 72

The averages, class by class, for all certificates issued to Ayrshire cows since the commencement of C O R. testing in 1912 are supplied by the following table .—

Table 12

Class	Number of Certificates	Average Yield for Season.		
		Days in Milk	Milk	Butterfat.
			lb	lb.
Two-year-old*	51	342	8,702·2	357·96
Three-year-old	32	345	9,947 9	406·57
Four-year-old	24	348	11,229·5	458·54
Mature	99	347	11,956·6	487·04
All	206	346	10,751·2	439·26

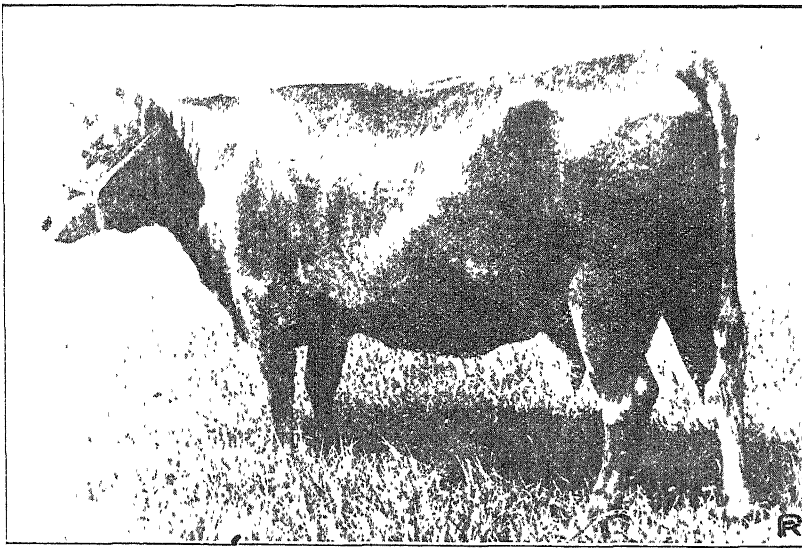
* No additions in 1929.

Ayrshire Bulls.

There have been no additions during the year to the list of Ayrshire C.O.R. bulls. The list numbers seven, and only two of these bulls added to their C.O.R. daughters in 1929.

Red Polls.

Only three Red Poll cows gained certificates in the year under review, and two of those had been granted certificates previously, so that only one cow was really added to the C.O.R. list of this breed. Of the three cows mentioned, one, Wayward 6 B No. 1, with a C.O.R. for 536·50 lb. butterfat, becomes leader of the mature class, replacing Dominion Sylph (505·84 lb.), a cow bred and tested at the Central Development Farm, Weraroa. Wayward 6 B No. 1 is owned by Mr. G. S. Young, of West Plains, Invercargill, and is the holder of the



WAYWARD 6TH B NO 1 (G. S. YOUNG, WEST PLAINS, INVERCARGILL).
Leader of the Red Poll two-year-old, four-year-old, and mature classes.

premier place in three of the four classes into which the breed is subdivided. It is quite obvious from a survey of this cow's performances that she is one of the leading matrons of the breed.

The class-leaders for the Red Poll breed are now as follows:—

Table 13.

Name of Cow and Class.	Tested by	Age at Start of Test	Fat required for Certificate.	Yield for Season		
				Days	Milk.	Butter-fat.
		Yrs dys	lb.		lb	lb
Two-year-old Wayward 6th B No. 1	G. S. Young, West Plains	2 188	259·3	365	11,228 0	511·42
Three-year-old. Dominion Gold Top..	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	459·46
Four-year-old. Wayward 6th B No. 1	G. S. Young, West Plains	4 297	343 2	365	13,290 0	580·05
Mature. Wayward 6th B No. 1	G. S. Young, West Plains	6 349	350·0	365	11 404 8	536 50

Red Poll Class Averages.

The average production of the three Red Polls certificated in 1929 —one in the two-year-old, one in the three-year-old, and one in the mature class—was 384·41 lb. butterfat. The averages, class by class,

for all certificates issued to Red Poll cows since the commencement of the C.O.R. testing for this breed in 1918 are shown in the following table :—

Table 14.

Class.	Number of Certificates	Average Yield for Season		
		Days in Milk.	Milk	Butterfat.
			lb	lb
Two-year-old ..	36	343	7,542·4	333·25
Three-year-old	13	346	7,881·1	313·17
Four-year-old* . ..	6	343	9,909·1	425·86
Mature	19	333	10,047·7	427·38
All	74	341	8,437·0	366·07

* No additions in 1929.

Red Poll Bulls.

Three Red Poll bulls have qualified for the C O.R. class so far. The past year brought no changes to the list for this breed.

Guernseys.

One Guernsey cow, Dominion Flora's Pride, gained a certificate during the year, with 593·29 lb. butterfat from 10,339·4 lb. milk, in 365 days, her age at commencement of test being 3 years 361 days. As the prefix "Dominion" implies, this cow is owned by the New Zealand Government She was tested at the Ruakura Farm of Instruction, Hamilton, and is the second Guernsey to be granted a C.O R. in New Zealand.

The friendly co-operation and valued assistance of the secretaries of the various breeders' associations has been continued, and we again desire to make cordial acknowledgment to Mr. W. M Tapp (Jersey Cattle Breeders' Association); Mr. J. P. Kalaugher (Friesian Association); Mr. A. W. Green (Milking Shorthorn Association); Mr. R. H. Spencer (Ayrshire Cattle Breeders' Association), and Mr. L. J. Wild (Red Poll Cattle Breeders' Association)

Salting of Cheese.—Some experiments on the influence of the method of salting upon changes in cheese have been made in Sweden. It was found that salting immediately after the whey was drained retarded the growth of bacteria, and bacteria in such cheese developed more slowly than in cheese not salted for three hours. The percentage of milk-sugar decreased and the percentage of acidity increased much more slowly in the cheese from the early-salted curds. Curds salted later stood more salt without becoming hard, brittle, and crumbly. One of the Canadian precepts respecting salting is, "Hold the curd until you believe it is ready for salting, and then give it a further fifteen minutes" This practice is conducive to a greater acidity in the cheese without showing in the body of the cheese as excess acid, and is considered to be conducive to greater closeness of body. This is particularly necessary in the warmer months, with their higher temperatures in the average curing-rooms *Dairy Division.*

AN ECONOMIC SURVEY OF THE POULTRY INDUSTRY IN NEW ZEALAND.

SUGGESTIONS FOR STABILIZATION.

ACTING under instructions from the Hon. G. W. Forbes, Minister of Agriculture, a comprehensive survey of the conditions surrounding the poultry industry has recently been carried out by the Farm Economics Section of the Department of Agriculture, under Mr. E. J. Fawcett, Farm Economist, and was published in report form at the end of last month. The necessity for such a survey arose owing to the unsatisfactory position of our egg-producers in the 1928–29 season. It was recognized that unless some reform could be brought about producers engaged in the industry must always be liable to the cyclic movement of depression and comparative prosperity which has characterized egg-production during the last twelve years.

The survey analyses the present position fully, covering organization of producers, markets, export, production costs, distribution of poultry stocks, production and consumption within New Zealand, and the importance of the industry to the country. Certain conclusions are arrived at, and suggestions made which are calculated to stabilize production either for local requirements or for export purposes. The following extracts from the concluding part of the survey are reprinted for the information of *Journal* readers :—

Conclusions.

(1) The poultry industry is of considerable importance in the economic life of New Zealand :—

(*a*) The products are a necessity in the family menu and rank very highly in food value.

(*b*) Eggs represent a considerable item of expense in the household budget where they have to be purchased.

(*c*) Poultry can be housed in a confined space, and are therefore kept by approximately 50 per cent. of the householders of the Dominion. In the majority of cases fowls are run primarily to supply the family, and, as scraps constitute the major portion of the feed of small flocks, eggs are produced at a minimum cost.

(*d*) The surplus eggs from side-line and back-yard flocks combined with the output from specialized and semispecialized farms represent a valuable article of commerce.

(*e*) Poultry flocks and plant represents a large capital outlay.

(*f*) Approximately 2,000,000 bushels of wheat, besides large quantities of other grain, pollard, bran, &c., are consumed annually by the poultry of New Zealand, and this has a very important bearing on the wheat-growing industry. The poultry industry affords an outlet for the bulk of the 25 per cent. of the total wheat crops which is classed as other than milling quality, and if this outlet were not available the position of wheat-farmers would be immediately affected.

(*g*) As a side-line to fruit-farming, dairying, and other small-farm enterprises, poultry contributes largely to the net income.

(2) The industry is difficult to organize because—

(*a*) It is carried on by a large number of people who use city markets as an outlet for their surplus production.

(*b*) As birds begin to produce at six months of age, it is possible to procure a greatly increased output in a short space of time.

(*c*) The poultry census is taken every five years, and it is therefore impossible to gauge accurately flock-movements and possible production.

(*d*) Owing to established commercial practice, it is difficult to obtain merchants' co-operation in marketing reform.

(3) The present position of the industry is unsatisfactory owing to—

(*a*) Overproduction, caused through—(i) prohibition of the importation of foreign pulp and imposition of duty, (ii) a consequent and cyclic period of high and low prices, (iii) Government guarantee on exported eggs during the 1928 season.

(*b*) Consequent on overproduction, prices declined on the local market in 1928, the price-level in the flush period being influenced by pulp contracts and carry-over from previous seasons.

(*c*) Despite the drop in price, food costs are maintained at a high level owing to—(i) protection afforded the wheat industry, (ii) lack of producers' organizations with financial backing, thus preventing the purchase of food in bulk direct from wheat producers' organizations, (iii) therefore, when wheat, &c., is bought in small lots the poultry-farmer pays all the cost of transport, handling, insurance, storage, and shrinkage, plus the profits of all middlemen, which at every handling is computed on an increasing value.

(*d*) Owing to lack of organized marketing, the reduction in price is accentuated by the condition in which eggs are delivered to the local trade, especially from small country flocks, where eggs are collected and held for some time before despatch to city markets

(*e*) The combination of low prices and high feed costs is forcing farmers to reduce flocks during 1929 or go out of the business altogether Thus capital is being directly lost. The movement of food and egg prices closely correspond Owing to the reluctance of farmers to lose capital, overproduction has taken place. The price of eggs has dropped more rapidly than wheat prices, giving the impression that it is food costs which are responsible for instability The present movement of flock-reduction will continue until, owing to restricted production, the price realized on the local market rises to an economic level to meet the costs of production. Thus another cycle will be completed.

(*f*) Owing to this typical price and production cycle the industry must always remain unstable if not properly organized.

(4) The study of farm accounts proves that conditions during 1928-29 were uneconomic on commercial poultry-farms. The surplus, after food costs were met, was barely sufficient to cover overhead expenses. Labour reward of the owner was small or non-existent. During the present season (1929–30) the position is likely to be so bad that side-line flocks will be reduced, in addition to reduction in total flocks caused by commercial farmers selling their plant.

(5) The position cannot be relieved by exporting the surplus, as conditions on the London market are not sufficiently bright to offer a remunerative return. In addition to comparatively low prices in London, the costs of handling and shipping are heavy, leaving a net balance below the cost of production. This loss cannot, under present conditions, be distributed over all eggs sold locally, as export is undertaken by a small proportion of producers only. To make large-scale export possible it is essential that all producers stand their percentage of loss If a small quantity only are shipped, no stabilization of the local market can be expected.

(6) Preserving, pulping, and chilling of eggs in large quantities may have an immediate effect on the price of fresh eggs, and must react detrimentally during the following season.

Suggestions for Stabilization of the Industry.

Before any attempt is made to reorganize the industry it is necessary that it should be decided whether it is a branch of primary production worth assisting or not. The study of its movements over a long period of years shows that the present position is not new. It is safe to assume that, if left to its own resources, the cyclic movement of prices and consequent prosperity and depression experienced over the last twelve years will be repeated. With every depression a direct loss is made on capital and a disorganization takes place in production. The producer loses directly, but the State loses indirectly.

Any disarrangement affects the commercial farmer first. The specialist is of great importance in maintenance of stock standards, and, although small in numbers, should be encouraged. The most important group of producers are those who do not wholly depend on poultry products for their living, but who rely on poultry to such a degree that great care is taken in management and in the class of product put on the market. It appears desirable that egg-production be continued as a stable industry on side-line farms. To safeguard the industry for this class and for the commercial owner certain regulations are urgently needed.

If the industry is thought of sufficient importance to warrant stabilization, then the following suggestions must receive serious consideration —

(1) *Export Subsidy.*—The Government subsidy granted for export eggs has not had the desired effect. Prices on the local market have not been stabilized, and, owing to the price received in London, little hope can be entertained that future shipments may be made on a self-supporting basis. Therefore this form of help should not be continued after the current season.

(2) *Poultry Census.*—Owing to the possible rapid movement in poultry-flocks, the present system of taking a census every five years is quite inadequate. It is imperative for the stabilization of the industry that an annual stocktaking be made, so that reliable figures are available. It would then be possible to gauge production and forecast movement of supply and prices from year to year. This would prevent violent dislocation of the industry, and consequent loss of capital. It would also tend to maintain prices at a more uniform level. The method considered most practicable for the collection of data is "That it be made compulsory for all poultry-keepers to submit an annual return as at 30th April, such returns to be made on a prescribed form issued by the Department of Agriculture and available at all post-offices or on application to local officers of the Department. The responsibility of making the return to rest on the individual, a penalty to be imposed for failure to comply Annual tabulation to be made by the Statistics Office."

(3) *Regulations governing Sale of Fresh Eggs.*—Regulations governing the sale of fresh eggs need to be framed for the definite object of ensuring the uniform grading of all eggs offered for sale, both on a size and quality basis. The case for a scheme of grading is detailed in the section of this survey headed "Standardized Grading." The question of compulsion is one which requires careful consideration. The optional scheme in England and Wales is giving excellent results. Undoubtedly a compulsory clause would ensure success, and would be fairer to all producers. A voluntary scheme, with the backing of the Government, merchants, grocers, and producers, would have every chance of success, but it would be slower in operation, and full control of pulp-manufacture and other methods of storage may not be possible at first. It may also be difficult to carry out a sound export scheme to relieve the local market unless all eggs are forced through a grading-store. As an indication of the feeling among grocers in the Dominion, the following resolution, passed at the annual conference of the New Zealand Master Grocers' Federation in February, 1929, is illuminating :

"That this conference urges the desirability of the compulsory grading of eggs, and suggests that, if this cannot be done by regulation, the necessary legislative action be taken to enforce same."

Need of a Standardized Grading Scheme for New Zealand.

The importance of the poultry industry in the economic life of the farming community is undisputed. Any developments which can be made on sound lines is to the advantage of the country as a whole. As an item of staple diet eggs stand very high, and rank close to bread or milk in the family budget. Despite its importance, the egg trade has in the past been the most haphazard and unsatisfactory of any commodity of daily use. If production and distribution is to be placed on a sound footing and the interests of consumers safeguarded, a standard system of grading is the first essential In discussing grading it must be understood to cover both size and quality. At the present time eggs are sold as "fresh" irrespective of age, condition, and, in most cases, size. Because they are sold in a sealed container (*i e.*, the shell) it is impossible for the wholesaler, the grocer, or the consumer to buy and sell with any degree of confidence, especially during certain periods of the year. The fault may lie with the grocer, the wholesaler, or the producer. In any case, it is the grocer and producer who suffer, and undoubtedly the latter are to a great extent responsible for the state in which eggs are placed on the market A great deal of the trouble arises through what are known as "grocers' collections" from outlying country districts, where a few dozen are collected and forwarded to central markets when sufficient have been obtained to make a consignment, the article finally arriving in the main markets in a very doubtful condition. This will always be difficult to overcome, and has led to the statement so often heard that egg-prices are controlled at certain times of the year by the inferior product. The doubtful condition in which many eggs reach the market directly affects the grocer, and it has been proved from records made available in the course of this investigation that grocers show practically no profit on the eggs they handle. They must be kept for the convenience of customers, but are generally considered to be a non-paying line. At the present time a small proportion of eggs are graded for the local market, but it is not fair that careful poultry-farmers should pay for the improvement in marketing, enabling outside producers to profit. If the commercial and semicommercial poultry-keeper adjacent to heavy consuming centres is to be encouraged—and it is to the advantage of consumers that he should be—then a more equable and satisfactory method must be devised to meet the situation. The advantages of a standard grading system in New Zealand would be :—

(1) The consumer would be guaranteed the quality of the article bought, and would pay a price according to the weight of eggs purchased.

(2) The grocer would be handling a uniform and satisfactory article, which would ensure him against loss, and enable him to feature eggs with the same confidence as other produce.

(3) Distributing merchants, agents, and co-operative concerns would operate on equal terms, and be able to give satisfaction to retailers and *bona fide* producers.

(4) Producers who aim to make a living or at least supplement their living by producing a high-grade article would be safeguarded against the detrimental effect of inferior eggs, and a gradual increase in flocks of this nature would result.

(5) The pulping, preserving, and cool storage of eggs would be facilitated, especially the pulping of eggs of otherwise good quality but which affect the sample of fresh eggs if mixed indiscriminately, as at present, owing to their poor appearance.

(6) In the event of export, grading and packings of suitable eggs in proportion to local production would be simplified and the cost reduced.

A Standard Grading Scheme on Voluntary Lines.

Suggestions for the establishment of a standard grading scheme on voluntary lines are as follows .—

(1) A committee to be set up to organize and control all matters pertaining to the scheme , such committee to be representative of producers, wholesalers, and retailers, with a Government nominee.

(2) The grading of eggs by weight and quality need not be compulsory to commence with. To encourage voluntary grading, regulations as follows should be enforced : (*a*) All graded eggs to be sold in cartons or from boxes clearly marked with grade and quality and the date such grading took place ; (*b*) all ungraded eggs to be advertised and sold as such, and clearly marked in retail shops as ungraded and carrying no guarantee ; (*c*) in the case of graded eggs sold from bulk boxes, or of ungraded eggs, a notice to be enclosed in all packets, stating the nature of the article sold.

(3) Grading-depots to be registered, as in England, but every endeavour to be made to establish central depots in each main centre, such depots to be common to all wholesalers or agents, who would have their own employee to receive, supervise grading, &c., and distribute produce. This would reduce overhead expenses, guarantee efficiency of staff, and reduce costs to a minimum. All grading should be under Government supervision

(4) Grading-depots should be central, and, if possible, adjoin cool stores and embrace pulping plant.

(5) Chilled and preserved eggs should be stamped and sold as such.

(6) Grades, both for weight and quality, to be as simple as possible compatible with efficiency, and as a basis of discussion those adopted by the National Egg-mark Committee (England) are suggested.

Funds : To initiate the scheme a certain amount of expense would be entailed in propaganda, &c , which would necessitate a Government grant. This could be considered in lieu of any export guarantee which may otherwise be given. Money spent on the organization of local trade would eventually be of greater value to the industry than a guarantee on export of surplus without internal organization The question of a levy on all eggs graded should be considered, and such levy come into operation as soon as possible

While suggesting an endeavour to establish a voluntary system, it is considered that compulsion should be resorted to if voluntary co-operation is not forthcoming.

Pulp.

At the present time pulp-manufacture undoubtedly exercises considerable influence on egg-prices both during the flush and short-production periods. Its manufacture on contract at low prices or for speculation demands a low egg-price level. Thus the tendency is for egg-prices during the flush period to be depressed. The holding of large quantities through the winter months tends to decrease the use of fresh eggs by pastrycooks during the late summer and early spring. A carry-over from one year to another constitutes a menace to the industry, and during normal production seasons becomes difficult to remove. Some form of control in pulp-manufacture and disposal is essential for the stabilization of the industry. Eventually any export of surplus should be in the form of pulp rather than eggs in shell.

Committee.

The establishment of a committee as suggested above should be the first step in organizing the industry. The duties of such a committee would embrace—(1) Advising the Government on any matter pertaining to the industry ; (2) drafting of rules and regulations to govern grading ; (3) propaganda to ensure success of any scheme brought into operation ; (4) control of pulp-manufacture, and, if occasion demanded, control of export of surplus products , (5) registration of grading-stores ; (6) arrangement of finance as advance on eggs or for purchase of food-supplies ; (7) any other consideration which may be expected to stabilize the industry.

A CASE OF OPENNESS IN CHEESE DUE TO YEAST FERMENTATION.

G. F. V. MORGAN, N.D.A., N D.D., Dairy Bacteriologist, Wallaceville Laboratory.

SAMPLES of cheese in the form of five plugs were lately received at the Wallaceville Laboratory from the Dairy-produce Grader, Napier, showing a very bad type of fermentation openness. This was unmistakably of bacteriological origin, the plugs being honeycombed with large, round, smooth-sided cavities of more or less regular shape.

In the examination of the cheese the usual methods of dilution and plating out were adhered to, and cultures were made respectively from a 1–10,000 dilution on litmus lactose agar, gelatine, MacConkey's neutral red agar, bile salt broth, and Sabouraud's medium for yeasts. All plates

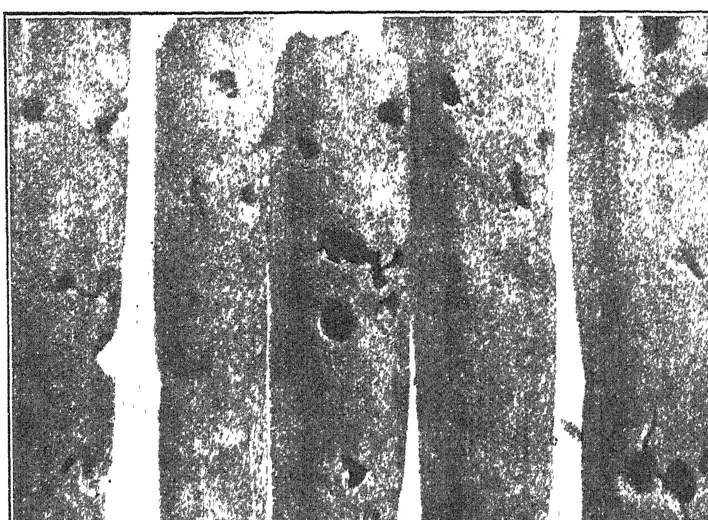


FIG. 1. PLUGS OF CHEESE SHOWING FERMENTATION OPENNESS.

showed the presence of yeasts to a marked degree, including the plate of MacConkey's agar, which may be considered unusual.

The plate of Sabouraud's agar, a medium especially suitable for yeast-growth, was totally uncountable in a 1–10,000 dilution. Examination of a representative number of colonies on this plate showed that the cultural characteristics of most of the colonies selected were similar and typical of *Torula cremoris* and its associated types; moreover, the typical smell (somewhat resembling amylic alcohol) usually present when this type of yeast is grown in pure culture was very noticeable on the Sabouraud's plate.

The transfer of a loopful of the 1–10,000 dilution from this cheese to sterile milk produced a smooth curd, but also showed the large

gas-holes similar to those present in the cheese plugs. Smears from this curd showed the predominance of *Torula cremoris*. In all other respects the cheese plugs showed a normal bacteriological flora, coliform organisms in particular being rather less prevalent than usual.

The cultural characteristics of *Torula cremoris* and associated types of yeasts may be briefly stated for those technically interested, as follows: Smooth plain-edged colonies on Sabouraud's agar, and other solid media suitable for its growth. Cells long, oval, and elliptical; traces of false mycelial growth found in old broth cultures and in the cheese plugs under consideration. (These will be noticed in the microphotograph of the smear taken direct from the cheese—Fig. 3). Vacuols irregular in number. Giant cells occasional. Litmus milk: Acid and gas at 37° C. (The type found present in these cheese slants, and similar types isolated in the past from butter, were also capable of

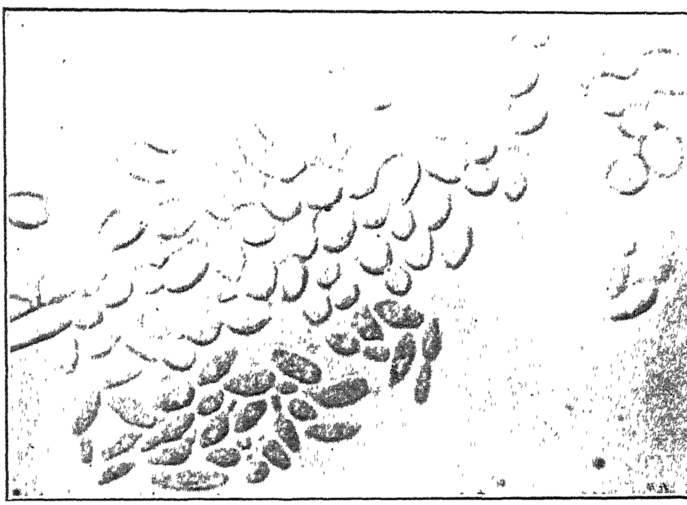


FIG. 2. MICROPHOTOGRAPH OF TORULA CREMORIS YEAST IN HANGING DROP SUSPENSION (UNSTAINED).

developing acid and gas at as low a temperature as 5° C.) Bouillons: Bottom growth. Beer wort gelatine stabs: Gas, but no liquefaction. Sugar reactions of type isolated from cheese (yeast water basis of bouillons): Acid in glucose, sucrose, lactose, galactose, levulose.

Yeasts of the above types have frequently been isolated from routine samples of butter received at this Laboratory, and have been found present in considerable numbers. They have also been found responsible for alcoholic fermentation in old milk-samples that have been allowed to stand for some time. Cultures added to pasteurized milks in experimental cheeses have produced typical cavities in the curd. This, however, is the first time that this yeast has been isolated here from factory cheese and has proved a source of openness.

The microphotograph of a smear taken from a cheese directly from the neighbourhood of these cavities has already been referred to. Fig. 2 is a microphotograph of this yeast unstained and taken by the hanging drop suspension method, showing clearly the morphology of the cells. Fig. 1 shows the two types of cavity produced in the cheeses examined.

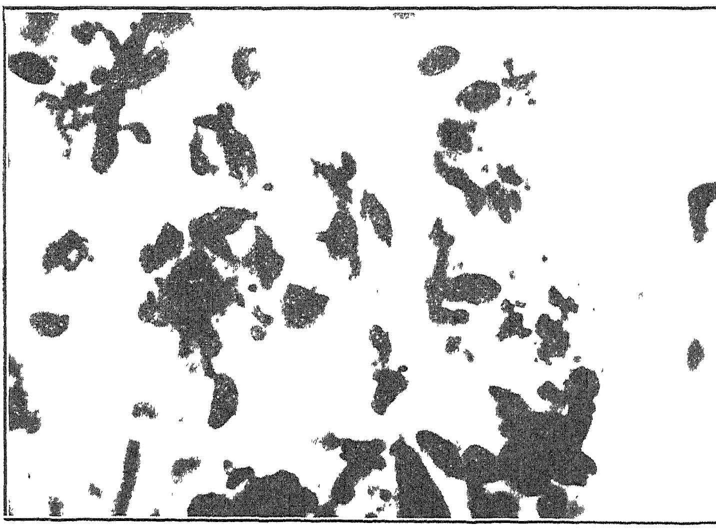


FIG. 3. MICROPHOTOGRAPH OF SMEAR TAKEN DIRECTLY FROM A CHEESE SLANT IN THE REGION OF A CAVITY.

It was intended to follow this matter up from the bacteriological standpoint at the cheese-factory the produce of which was affected. Later advice was received, however, that the Cheese Instructor for the district had visited the factory and that an improvement in the milk-supply had overcome the trouble.

CALCULATING YIELD OF STANDARDIZED CHEESE PER POUND OF FAT.

THE yield of standardized cheese should be calculated on the weight of the fat contained in the whole milk, less the weight of fat contained in the cream of the milk which was skimmed; and the fat in the cream, whether disposed of as cream or made into butter, should be credited to either cream sold or butter manufactured.

This method ensures compliance with the requirements of clause 4 of the Dairy Industry Amendment Act, 1922, prescribing the statement of overruns and yields which are to be furnished annually by dairy companies to their suppliers. Under this clause it is not necessary to take cognizance of the fat in the skim-milk.

—*W. E. Gwillim, Assistant Director of the Dairy Division.*

DISEASES OF DAIRY COWS.

J. Hill Motion, B Sc (Agri.), B.Sc. (Vet.Sc), M.R C.V.S , D.V.S.M., Animal Bacteriologist, Wallaceville Veterinary Laboratory

IV. TEMPORARY STERILITY—*concluded.*

(3) PHYSIOLOGICAL DERANGEMENT.

A physiological derangement of the genital complex may presumably result from many causes, the most important of which are (*a*) pathological conditions arising from infection or otherwise , (*b*) deficiencies in the pasture or the diet, resulting in malnutrition or undernutrition ; and (*c*) irrational management and overproduction.

Pathological Conditions—Infection, as previously mentioned, may have some place in the etiology of temporary sterility, for in many herds experience would appear to justify such a conclusion A newly purchased cow, a new bull, or a bull which has served cows belonging to a neighbour, has often appeared to bring in " infection," and many farmers are still confident that herein is to be found the sole cause of this temporary failure to conceive. It remains, therefore, to appreciate how infection can bring about the condition without presumably, in the majority of cases, manifesting any trace of pathological change in the genitalia.

In countries where the dairy cows are housed almost half the year breeding anomalies are common, and accordingly infection of one part or other of the genital tract is usually met with. The published figures from America would suggest that infection of the uterus occurs there in about 50 per cent. of cases of sterility, and in almost half of these infection is to be found extending up the uterine tubes towards the ovaries. The deep crypts and folds of the uterine tubes and even the cervical canal are the most favourable situations for infection to find lodgment, and this has proved to be the case. With regard to infection of the uterus or womb itself, it may be said that unless there is a very severe infection over a relatively long period definite changes cannot be produced which might render this organ functionally inactive. Infection may cause a derangement in many ways by favouring a fibrosis with occlusion even, an atrophy or hypertrophy of the uterine epithelium, by calling forth an inflammatory response in the affected tissues. Toxic products of bacterial activity, increased alkalinity or acidity, and even more acute pyogenic processes, may lead to death of the sperms before conception has occurred, or even inhibition of implantation after normal fertilization.

Pathological conditions of the various regions of the genital tract may therefore act more by preventing conception, rather than by directly favouring a physiological functional derangement of the sexual sequence in the cow herself. It must be remembered, however, that in the presence of an endometritis, and depending upon its severity, the occurrence of œstrum tends to become irregular, and more particularly so if infection persists for two or three months after calving. Cervicitis and salpingitis have therefore received more attention with reference to temporary sterility, but exhaustive investigations in many parts of the world have failed to establish any definite relationship.

Deficiencies in the Pasture or Diet.—With regard to the question of a functional derangement, either pathological or physiological, resulting from a deficiency in the pasture or drinking-water, many facts would appear to point in this direction. Firstly, in most cases, beyond perhaps a slight cervicitis or even cystic condition of the ovaries, which do not lead to any interference with the normal sexual cycle, no real evidence of any serious pathological changes have been demonstrated. Secondly, after several unsuccessful matings the cow eventually conceives too late in the season and carries her calf to the end of a normal gestation. Finally, a period of sexual rest, as when a cow is held over till the next season, will suffice to lead to a successful first service. These facts suggest a temporary derangement resulting from possibly a temporary deficiency of some sort, which under New Zealand conditions can only be taken as a deficiency in the pasture or drinking-water.

A deficiency in the soil would of necessity be a permanent one, and a deficiency of the pasture would result, and sooner or later this would be reflected in the grazing animals unless remedied, where the conditions permitted, by the application of suitable soil-dressings. Such conditions exist in various parts of the world, and in others a depletion of the soil is going on, under conditions of grassland farming, where milk, wool, hides, beef, and mutton have been produced and removed for generations without any attempt being made to make good the loss of the essential minerals for plant-growth and therefore animal husbandry. Under such conditions malnutrition and sterility are known to have occurred amongst dairy stock. The possibility of such an occurrence—a progressive depletion of the soil, as apart from an actual soil deficiency—must not be neglected, even in New Zealand, which is a comparatively new country.

This soil depletion and soil deficiency would of necessity lead to more permanent ill effects, but temporary sterility cannot be so classified, since most cows which fail to conceive in the early summer are found to be in calf by February or March. This suggests possibly only a temporary deficiency in the diet of the cow in the spring months, either just before calving or during the months which immediately follow. The normal diet of the dairy cow—that is, grass (and, of course, water), must come under suspicion.

The chemical composition of the pasture varies throughout the year, depending upon the variety of plant species and the stage of growth. The animal grazing freely will instinctively select the herbage to meet its particular requirements, at least as regards the proximate principles, carbohydrates, fats, and proteins, together with palatability; but as regards the mineral elements for ordinary metabolism the supply would possibly not meet the seasonal demand, and systemic depletion would of necessity result. Calcium, phosphorus, and perhaps iodine, as already mentioned, are generally considered of the greatest moment in animal nutrition, or at any rate are the elements which have received the most consideration in connection with the problem of sterility. It is interesting to note from the few figures to hand of pasture-analyses—from one dairying district at least—that there appears to be a sufficiency of lime, but a reduction in the phosphorus content. More extended work in this direction is needed, however, before anything

approaching a conclusion can be reached From another source the soil iodine for the same area is reported to be as high as in any part of the North Island.

Presumably, calcium may be ruled out as a possible cause of temporary sterility. The question of phosphorus deficiency is an important one, but when one refers to conditions under which an aphosphorosis occurs in bovines it is found that œstrum does not occur, and a persistence of the lutein bodies is met with. Feeding of bonemeal, &c., and also expression of these bodies may lead to conception at a subsequent service. Professor Folmer Nielsen submits definite evidence against the hypothesis that "persistence of the lutein body" is a cause of sterility. By repeated rectal examinations of the ovaries in sterile cows he showed that the lutein bodies disappear and reappear after ovulation, and in many cases without the cow showing any sign of œstrum. Again, lutein bodies cannot be demonstrated more frequently in the ovaries of sterile cows than in normal cows. Finally, lutein bodies can be palpated in the ovaries of normal cows in 100 per cent. of cases, but often only in 75 per cent of sterile cows, from seven to ten days after œstrum. The obvious conclusion to be drawn from these facts would be that ovulation in infertile cows occurs in less close relationship to heat than is the case in normal cows.

If this interpretation be correct, then a deficiency of phosphorus appears to lead to a derangement of the temporal relationship of ovulation and œstrum. In extreme cases of aphosphorosis malnutrition results, and of course sterility, without the regular occurrence of œstrum. In less extreme cases, it is feasible to assume that a temporary or even slight permanent deficiency of phosphorus in the soil may lead to temporary sterility, without clinical evidence of malnutrition or suppression of œstrum.

With reference to the soil iodine, which appears to be adequate in areas where temporary sterility is common, it must be remembered that a high iodine content is not reflected in the pasture till late in the season; in fact, the early spring growth is relatively low in iodine. Thus at the time when the animal requirements are high and the systematic depletion is greatest there results a definite deficiency, which, of course, is only of a temporary nature.

In this connection it is necessary to take into consideration the amount of iodine which the animal is likely to get in the drinking-water, for should the iodine content of the latter be relatively high the obvious temporary deficiency in the pasture would be necessarily counteracted. The iodine content of river-water from formations rich in lime and magnesium has been found to be relatively low, and snow or glacier fed rivers are notoriously deficient in iodine, more especially so during the melting of the snow. Hercus, Benson, and Carter give figures for three South Island rivers rising in the Southern Alps as nil, 1 gamma*, and 2 gammas of iodine per litre respectively. More recently Shore and Andrews found that the iodine content of upland surface water in the Taranaki region varied from 0·45 to 0·75 gamma of iodine per litre. This was the lowest figure obtained in a recent survey of iodine content of potable waters in the North

* A gamma (γ) equals one-millionth part of a gramme.

Island. It is interesting to find that artesian well-water is ususally very high in iodine The water-supply of Taranaki is chiefly derived from Mount Egmont, and this would naturally account for the relatively low iodine content of same. The relationship of iodine to the activities of the thyroid gland, and indirectly its action on the genital organs, was discussed in the first part of this article.

It is interesting to learn that in 1924 Stiner, while experimenting with iodized salt on milch cows, observed that his control cows had to be served twice or three times before pregnancy resulted, whereas as a rule one service was sufficient in the cows fed on iodized salt.

Another point of interest in connection with top-dressing of pastures deficient in iodine is that many samples of both basic slag and superphosphate have been shown to contain no iodine; in fact, the amount present appears to vary with the source of orgin. These facts have been established by Hercus, Benson, Carter, and Roberts in New Zealand.

Although the information submitted would appear to favour the hypothesis that a deficiency of iodine, even of a temporary nature, is a cause of temporary sterility in bovines in New Zealand, it must be understood that the problem is far from solved, since many other factors find an equally important place among the statistical evidence now being amassed from herd records At the same time, the iodine metabolism in animals is still imperfectly understood, and also, what is of greatest importance perhaps, the effect of iodine on calcium and phosphorus metabolism. A deficiency of both iodine and phosphorus may supply the explanation of many cases of temporary sterility.

With regard to the possibility of a deficiency of the anti-sterility vitamin E, which has recently been discovered, it is feasible to assume that such may occur in cows which are suffering from malnutrition from pasture deficiencies, or undernutrition on account of irrational management. A complete systematic depletion of vitamin E is hardly possible, whereas an excess of this accessory food factor in the succulent spring feed could possibly bring about the condition when pregnancy may not occur. Sufficient evidence is not yet available to warrant a definite opinion regarding the importance or otherwise of this vitamin.

Undernutrition resulting from irrational management will be more easily discussed under the next heading.

Irrational Management and Overproduction.—High individual production has been recently cited as having an important bearing on temporary sterility, but although a considerable amount of valuable material is available from the herd-testing records no definite pronouncement is yet possible.

Official statistics show that the dairy-cow population of New Zealand has increased by about 65 per cent. during the last ten years, and also that the increase in butterfat-production has been particularly rapid during the same period, amounting to approximately 130 per cent. It is significant also that there has been over 600 per cent. increase in butterfat-production during the last thirty years. This increased production has been due to the rapid increase in dairy stock, a grading-up of same,

a marked improvement in grassland farming, and an increasing practice of top-dressing The production per cow has increased by some 80 per cent. in the last thirty years

In the earlier days of settlement the natural fertility of the soil would appear to have provided the necessary material for the relatively low-producing dairy stock, but altered circumstances called for improved methods of dairying, and top-dressing was the outcome. How far a continuance of existing methods are possible is very difficult to say, but it can readily be appreciated that it will become more difficult and necessarily more expensive to maintain this steady improvement. It is therefore feasible to assume that in some districts and on some farms the limit has been reached. Many farmers have realized the situation and have provided in advance for the changing conditions, and winter feeding with hay, supplemented where practicable with roots, is becoming more and more a regular practice.

It can be accepted that innutrition during the winter months, just at the time when great demands are being made upon the pregnant animal, is bad and likely to exert a considerable influence in the incidence of temporary sterility. When individual production is being pushed by culling and breeding according to authentic milk-yields the nutritional requirements of the dairy stock must necessarily be attended to also More than a decade or so ago the cow was capable of deriving the essential constituents for normal metabolism and production, but the high individual butterfat tests now recorded would call for different management. Recent figures from the best dairying districts indicate that the herd averages have rapidly increased. In many cases this may be by judicious stocking and liberal manuring, but it is only recently that attention has been focussed on production per acre as the only economically sound policy for the future. High individual milk and butterfat yields assuredly lead to a systematic depletion, unless the increased requirements for greater milk-production are met in some other way

The management of the dairy stock is important, and on many farms leaves much to be desired. The present practice or aim is to calve practically all the cows during July and August, but owing to the incidence of temporary sterility in the herds it is found, for example, that not more than 60 per cent. of the cows in Waikato district calve before the end of August. With the increase of temporary sterility in a herd more cows come in late each year, and the tendency is for these cows to be put to the bull earlier than would otherwise have been the case. The same naturally applies to the heifers, for calves from late-calving cows will be mated younger than would otherwise be the case, in order to calve down in July or August when perhaps only twenty-one months old This practice, necessitated by late calving resulting from delayed conception is economically unsound, for the loss in future production and the risk of physiological derangement of the sex organs are too serious to be discounted. Many farms experience difficulty in getting the heifers in calf without repeated services. Here the reason may be twofold—firstly, breeding when too young, as already stated, and, secondly, improper management of the young stock, which ought to be looked upon as the basis of the future herd. These followers must be well cared for, and perhaps more so than the cow which has already come into profit.

There is always a tendency for dairy-farmers to favour early calvings in order to utilize to full advantage the spring feed right up to the summer dry conditions. There is something to be said for this system, which is useful after open winters, but obviously bad in backward springs. In other words, the seasonal variation limits the farmer to an overabundance of green food during a relatively short period, and a corresponding shortage of forage at other times. Silage will meet the herd requirements during the summer dry spell, but only winter feeding with hay, supplemented where practicable with roots, will ensure a satisfactory start for the milking-herd, following early spring calvings, even when feed conditions are otherwise favourable.

Very early calvings may give the long milking-period, but the risks attending such practices will manifest themselves in other ways, and temporary sterility may be the most costly to reckon with.

The Bull as a Factor in Temporary Sterility.

Before concluding this survey of the situation regarding temporary sterility it will be advisable to consider what influence the bull may have on the incidence of the trouble. This may with advantage be discussed under two headings—firstly, the effect of an infection or other pathological change on fertility, and, secondly, the possibility of a temporary physiological derangement resulting from deficiencies in the diet or even irrational management.

Infection or Pathological Conditions.—These may act directly on the bull, preventing normal coitus, or, where service appears to be successful, inhibiting spermatogenesis or causing the death of healthy sperms at or immediately following coitus. Again, infection may not necessarily render the bull infertile, but may be passed on to the female, when she will become sterile. Inflammations in various parts of the male genitalia have certainly been very often met with, but unless these are severe and long-standing, with resulting pathological changes, it is hardly feasible to assume that mild inflammations can interfere with the normal functions and power of reproduction in the bovine species. One need only appreciate the many acute venereal diseases met with in the lower animals which, in spite of very severe manifestations, rarely lead to sterility. Certainly in a herd where all the cows are returning to the bull it is possible that the bull is incompetent, and cases have been found where such infertility can explain the reason why conceptions have not occurred. Another bull generally manages to prevent further returns, but on many New Zealand farms this is not the case, and 100-per-cent. sterility is the exception to the rule.

One would presuppose that infection had been passed on to the cows, which are able to throw it off in the course of two or three months, when conception is possible; again, a sexual rest till the following season will act in the same manner. Evidence has been brought forward to show that contamination of the new bull has resulted after service of the "infected" cows. Sufficient statistical evidence is not yet available to warrant an acceptance of this hypothesis, since the possibility of the second bull being already infertile cannot be overlooked. The fact that probably some 50 per cent. of the cows in a herd conceive at the first or second service

would appear to negative the assumption that the infertility rests with the bull. Further, on most farms the same bull is able to get all cows in calf by the late summer.

Temporary Physiological Derangement.—This aspect of the problem would appear to offer much useful information which might have a direct bearing on infertility. Deficiencies in the pasture may lead to a temporary physiological derangement of function, and more especially so at the time of the year when the bull is required to furnish 100 per cent. successful services in the short period of six weeks to two months. As has been discussed in connection with the female, the diet of the male may be far from satisfactory at least as regards the requirements for fecundity. An 80-per-cent. success is generally accepted as a reasonable estimate of first-service conceptions, but in herds with contagious abortion, where service follows too soon after parturition, the percentage would possibly be much lower.

Professor Folmer Nielsen has offered several interesting facts concerning the male as an etiological factor in sterility, which are worth recording. Excluding those cases where the male is manifesting a demonstrable genital or extragenital disease, and considering only the clinically normal male, Nielsen submits evidence, confirmed also by Saunders in England, that in stallions, and in males generally, the animal is neither fertile nor sterile, but that there are periods of both low and high fertility governed by factors as yet very indefinitely known. Stallions which have always been healthy and have mated normally have been known to vary from 10 to 60 per cent. fertility over a period of years, with a drop from the maximum to the minimum and back again to the maximum.

Overcondition and lack of exercise are well-known causes of reduced fertility in the male, whereas malnutrition and excessive use are equally important The position may be summarized by stating that apparently normal males vary among themselves, and the individual animal may also vary from season to season, month by month, and even day by day. The cause of this variation will probably not be demonstrable, but it would appear to be physiological and not pathological.

Spermatogenesis may proceed at a variable rate, and the conservation of the power of fertilization may also vary, so that a definite number of services may lead to infertility in one animal more rapidly than in another Valuable information regarding the intensity of spermatogenesis may be obtained by several test matings in rapid succession, whereas the estimation of the spermatozoa—their viability and morphology—would give much useful data regarding the incidence of diminished fecundity in the bull. An intensive study of the part played by the bull in herds suffering from temporary sterility has been recently undertaken by the research officers of the Department of Agriculture in New Zealand, but detailed information of the findings is not yet available.

CONCLUSION.

Before concluding this survey of the problem of temporary sterility the writer would wish to state that many facts here submitted are not

necessarily conclusive, since the whole subject is a very intricate one, with many ramifications, commanding the attention of specialists in various fields of science. Chief among these may be mentioned those specialists in animal husbandry, economics, physiology, bacteriology, and pathology. At the same time the writer, without wishing to submit a definite hypothesis, has attempted to present an unbiased interpretation of the data at present available in America, Europe, and New Zealand. It must therefore be appreciated that not one factor merely, but many, will be found to account for the condition grouped under the one title of "temporary sterility."

The percentage incidence of sterility, and the regularity of the recurrence of œstrum in the individual members of the herd, are perhaps the most important points to consider when seeking an explanation of the "returning to the bull"; whereas the blame may finally rest on the bull, the cow herself, or the pasture and diet generally. Irrational management, which of course cannot be overlooked, has in certain herds been proved to be the cause of the trouble. In this connection may be mentioned too early calvings, breeding when too young, failure to supplement the feed under certain conditions, excessive use of the bull, indiscriminate interference as affecting sex hygiene, and, finally, soil-depletion as reflected in the dairy stock.

In concluding this series of articles on the Diseases of Dairy Cows the writer wishes to express his indebtedness to his colleagues in the Department of Agriculture for many helpful suggestions and for their valuable assistance, willingly given, in various directions. A considerable amount of very valuable information has been placed at the writer's disposal, and without these data a complete survey of the situation, embodying the large volume of work already done in New Zealand, would have been impossible.

CARBONATE OF IRON FOR BUSH SICKNESS.

IN the *Journal* for April, 1929, page 233, reference was made to an iron carbonate, known as spathic iron-ore, occurring naturally in Auckland Province, which was being tried for the treatment of bush sickness in cattle. Since then the experimental use of this material has been extended and found to give excellent results, so that a certain group of farmers are anxious for further supplies. Arrangements have therefore been completed whereby a regular supply is assured. The finely powered iron-ore may be mixed with an equal weight of coarse agricultural salt, and the mixture given as a lick to cattle. The experiments have been successful hitherto with milking-cows and calves. The Chief Chemist, Department of Agriculture, P.O. Box 40, Wellington, will be glad to hear from any farmers in the bush-sick areas who wish to experiment with this new remedy.—*Chemistry Section.*

SPARTINA TOWNSENDII.

A VALUABLE GRASS FOR RECLAMATION OF TIDAL MUD-FLATS.

(Concluded from November, 1929, issue.)

H. H. ALLAN, Systematic Botanist, Plant Research Station, Palmerston North.

2. Experience in New Zealand.

The introduction of *Spartina* into New Zealand was recorded by the writer in the *New Zealand Journal of Science and Technology* for November, 1924, as follows: "In 1913 a number of plants of *Spartina* were obtained by Mr. K. W. Dalrymple from Southampton Water and planted out in small clumps on the Foxton mud-flats in the tidal estuary of the Manawatu River. The clumps were considered to consist of specimens of both *S stricta* and *S. Townsendii*, but unfortunately it is not certain that the latter has established itself. All the clumps that have flowered have proved to be *S. stricta* (this identification being confirmed by Professor Yapp, and at Kew). It may be, indeed, that no *S. Townsendii* was planted, but a close watch is being kept, and any occurrence of this species will be recorded. The clumps were put in bare mud below high-tide level. One clump has thriven markedly. By 1915 it had formed a dense mat 1·8 m. across. The area was again visited on 11th February, 1923, when the patch was found to measure 12·8 m. by 7·2 m. The sheet was dense and short in the central portion, which was becoming mounded by accumulation of mud, and luxuriant on the margin of the deeper tidal channel. There were a few flowering culms that proved the clump to be *S. stricta* On the 16th March, 1924, the patch had increased to 14·3 m. by 7·4 m., the longer diameter parallel to the tidal channel. Some slight progress had been made towards crossing the channel, here about 1 m. below high-tide level. This patch and several of the others were then flowering rather freely, especially towards the margins." Additional information has since accrued, and is here recorded.

IDENTITY OF THE SPECIES ESTABLISHED AT FOXTON.

Misled by the short growth of the greater part of the main patch, I had concluded that this was made up of *S. stricta*. The late Professor Yapp examined specimens and agreed with this determination. He forwarded the specimens to Kew and received confirmation of this identification. Later on specimens taken from the more vigorously growing portion were sent to Professor Oliver, who determined them as *S. Townsendii*. Dr. Stapf thoroughly agreed with this view, and also examined the original specimens forwarded, finding them also to be *S. Townsendii*. In the meantime Dr. J. P. Lotsy had visited the area with me on 9th May, 1925. He considered the plants to be definitely not *S. stricta*, but hesitated to pronounce them as *S. Townsendii*, as they lacked the characteristic luxuriance of that species in Great Britain. At the time of his visit the more luxuriant portion was still under water and could not be properly examined. Close examination of all the patches has since shown that the plant

established is *S. Townsendii*. Only in one patch is there a bunch of what may be *S stricta*, if it is not the same as the special bunches in the main patch described farther on. This, however, has not so far been observed to flower.

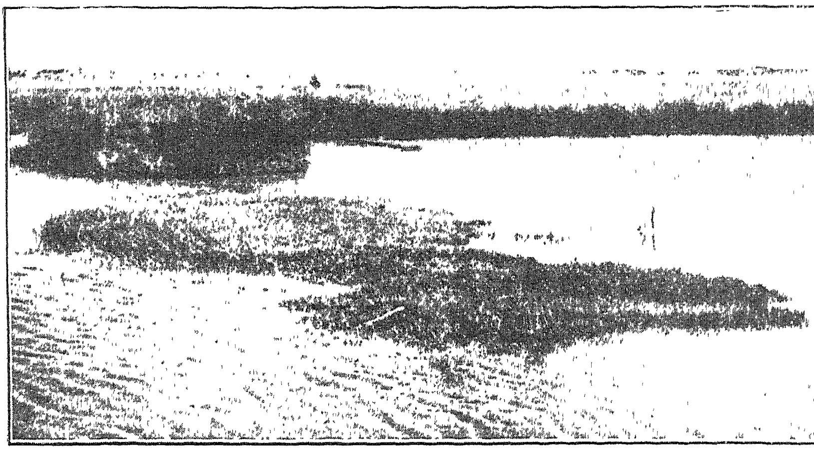


FIG 1. MAIN PATCH OF SPARTINA TOWNSENDII BECOMING UNCOVERED BY TIDE. PHOTO, MAY, 1924.

The short growth of the mounded portion is to be noted. *Juncus* had not at this date invaded the patch

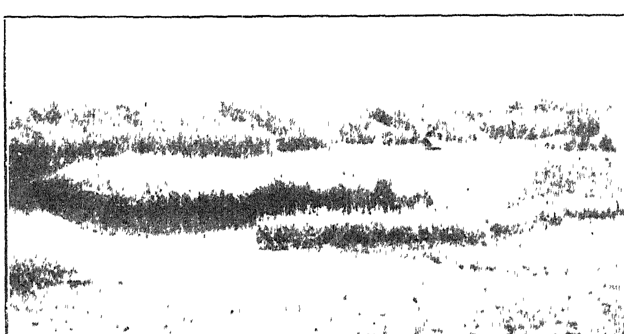


FIG 2. MAIN PATCH OF SPARTINA, JANUARY, 1930.

Showing raising of level by accumulation of mud Established clumps of *Juncus* on right

[*Photo by K. W. Dalrymple.*

On the occasion of Dr. Lotsy's visit I planted out on a piece of soft mud three small clumps taken from the centre of the large patch and representative of the short dense growth there shown. These clumps were placed in line near a shallow side drainage-channel at 3 ft. apart. Their places in the main patch were filled with luxuriant

marginal clumps A few clumps were also planted out on a much higher and firmer piece of bare mud-flat, but these did not survive A specimen of *S. stricta* that had been kindly sent out by Professor Oliver, and which arrived in very fair condition, was also planted out in the softer mud. This unfortunately was washed out by the scour before it had established itself. In their new situation the three short-leaved clumps grew luxuriantly, while those that replaced them in the main patch gradually lost vigour and became indistinguishable from the surrounding growth

In the main patch are two or three small bunches closely resembling the bunch that I have suggested may be *S stricta* These were noticed in 1923, and have increased very little in area since that date. They are at once distinguished from the rest of the patch by the almost erect, rolled-up leaves. They have flowered this season, and, as the following table shows, possess characters closely approximating to those of *S. stricta*. A difficulty that has been felt as to the hypothesis that *S. Townsendii* is really a first cross between *S stricta* and *S. Townsendii* is that the seedlings of the latter show no evidence of segregation. This is surprising if, as Oliver ("Spartina Problems," *Annals of Applied Biology*, vol. 7, 1920, p 29) says, "as seem almost certain, it is largely propagated and spread by seed." While non-segregation does not absolutely preclude the possibility of *S. Townsendii* being a first-cross hybrid, such cases are quite uncommon. The clumps here discussed certainly suggest strongly that segregation may occur to a greater extent than has been suspected. The offspring more closely approximating to *S. stricta* would tend to be crowded out and suppressed by those more closely approximating to *S. Townsendii*, unless, as in the Foxton patch, the growth of *S Townsendii* is checked for any reason. It is impossible to say whether these *stricta*-like bunches are seedlings from the *Townsendii* or are the original clumps planted as *S. stricta*. Certainly in the vegetative state there is little to differentiate them from *S. stricta*.

——	*S. stricta* (Herbarium Specimens)	Suspected Segregate from *S Townsendii* at Foxton.	*S. Townsendii* at Foxton
Culms . . .	± 15 cm. long	± 55 cm long, close together	± 70 cm long, more distant
Leaf-blades	± 20 cm long, ± 5 mm. wide at base; coriaceous, strict, erect, convolute, pungent-pointed, polished	± 20 cm long, ± 7 mm wide at base; coriaceous, strict, ascending at a narrow angle, *convolute, terete in outline*, pungent-pointed, polished	± 25 cm. long, ± 9 mm. wide at base, less coriaceous, ascending at wider angle, drooping at tips, flat or very slightly inrolled, subpungent, hardly shining.
Panicle . . .	± 15 cm of 2 to 3 spikes, ± 6 cm. long	± 15 cm. of *2 spikes*, ± 12 cm long	± 30 cm. of 4 to 9 spikes, ± 17 cm. long
Lower glume . .	± 15 mm. long, linear, acuminate, very silky—hairy	± 15 mm. long, linear, *acuminate*, silky—hairy	± 12 mm. long, linear, obtuse to subacute, less silky—hairy.
Upper glume . .	± 20 mm. long, linear—lanceolate, bifid, awn-tipped, keel scabrid	± 20 mm. long, linear—lanceolate, *bifid, awn-tipped* or nearly awnless, keel somewhat scabrid	± 18 mm. long, narrow—lanceolate, not bifid, acute to almost acuminate, awnless, hardly at all scabrid.
Rachis	Just protruding beyond last spikelet	Protruding for ± 1 cm beyond last spikelet, practically straight	Protruding for ± 2 cm. beyond last spikelet, flexuose.

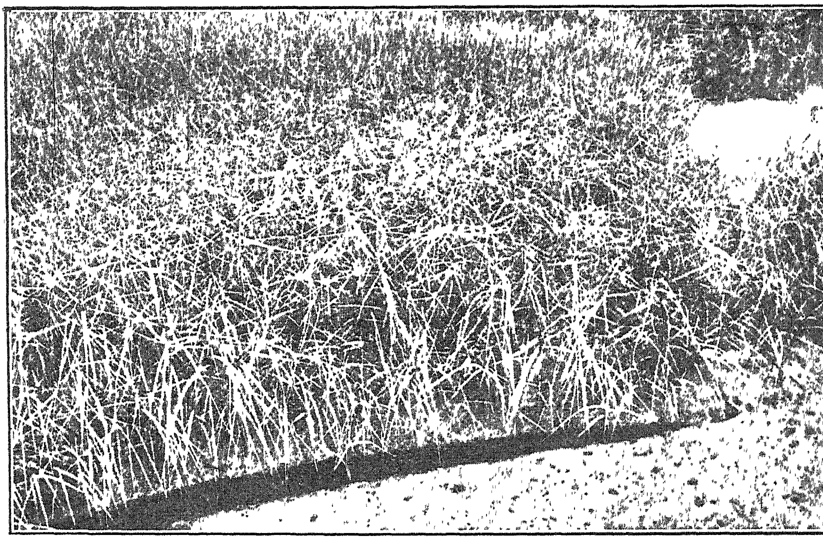


FIG. 3. MAIN PATCH OF SPARTINA, FEBRUARY, 1930.

Showing luxuriant growth at edge of drainage channel.

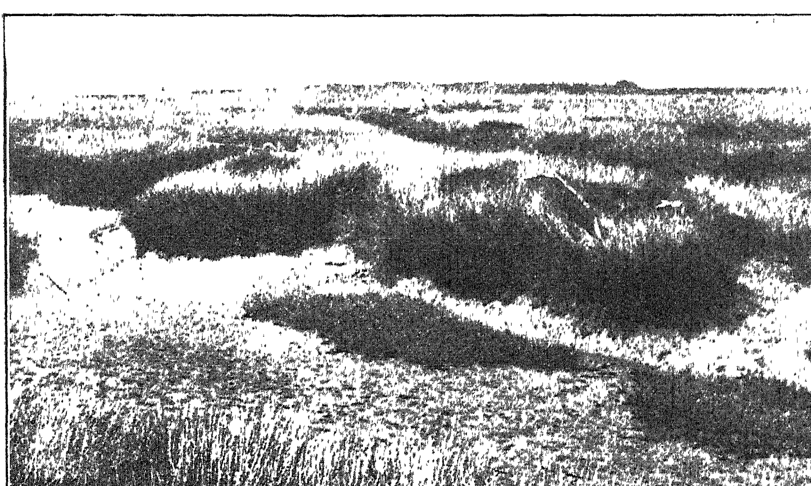


FIG. 4. PATCH OF SPARTINA ESTABLISHED FROM THREE CLUMPS PLANTED OUT IN MAY, 1925.

Showing surrounding *Juncus* association. Advancing edge of main patch on right. Photo, February, 1930.

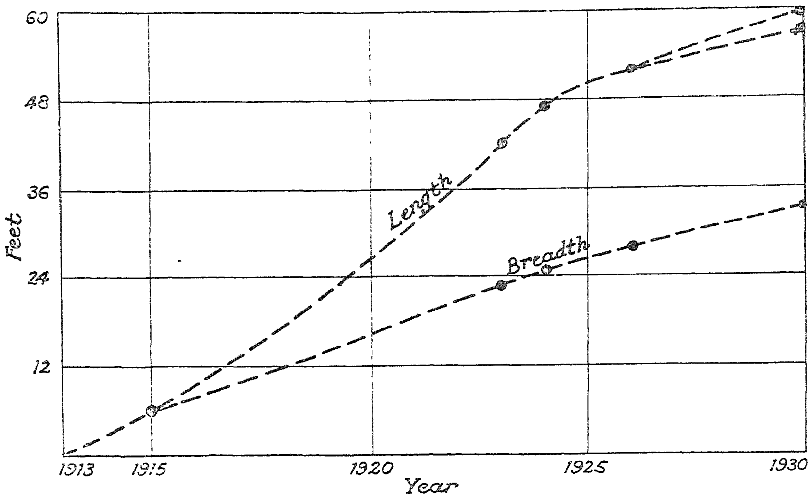
RATE OF GROWTH AND ESTABLISHMENT

The main patch was remeasured on 22nd November, 1926, showing then a length of 52 ft., with a breadth of 28 ft On the seaward side it had almost reached the *Juncus maritimus* association, while on the landward it was still held up by the side drainage-channel. Measurements taken on 22nd February, 1930, gave 57 ft. for the length and 33 ft. for the width The patch had then extended round the shallower end of the side drainage-channel for about 3 ft. Growth along the edge of the main drainage-channel was very luxuriant, but the grass had not succeeded in crossing it. The banking-up of the channel by the grass has caused increased scour and deepening, and in places it was evident that the bank had been undermined and clumps of the grass carried away. One clump had established itself farther down the channel near the point where it reaches the estuary waters. On the seaward margin the patch had joined the *Juncus* association. The marginal growth on the side more remote from the channel was much less vigorous. Here the grass is submerged for only a short period per tide, and the mud is of a much firmer consistency, the feet hardly sinking in at all as one walks over it

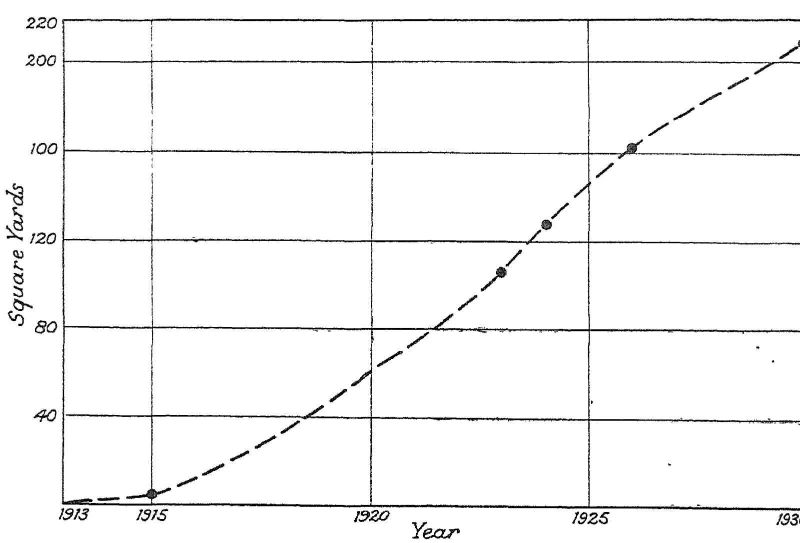
As will be seen from the accompanying graphs, the growth is fairly comparable with that recorded for Great Britain—from 2 ft. to 3 ft. per annum. But there has been no sign of increase by seedlings, and only small increase by detached clumps. In the seventeen years since planting the main patch has grown to roughly $\frac{1}{24}$ acre. All the original clumps show considerable increase, this being more marked in those at lower levels in the softer mud, where too the plants are much more luxuriant. The three clumps taken from the short growth of the main patch in 1925 have made good growth, and there is now a continuous patch of luxuriant grass 18 ft. long by 7 ft. wide. The slackening-off of the rate of growth in the period 1925–30 as compared with that of 1920–25 may be attributed to the barrier opposed by the tidal channel, the higher firmer mud on the further margin, and the competition with the surrounding *Juncus* association.

COMPETITION WITH INDIGENOUS VEGETATION.

In the paper cited I said of the indigenous vegetation of the Foxton mud-flats: "*Juncus maritimus* var. *australiensis* and *Leptocarpus simplex* are dominants, both forming very extensive dense sheets, the latter usually seaward of the former and less in extent. There is not wanting evidence that in this locality the *Juncus* invades the *Leptocarpus* sheets and tends to subdue them. The areas of bare mud are not extensive, and in the *Spartina* neighbourhood border the tidal channels. Between the margins of the dominants and the bare mud there may be patches of *Scirpus americanus, Salicornia australis*, or *Triglochin striata* var. *filifolia*, the latter pair with or without other small species. Certain of the *Spartina* patches have now approached closely to the margins of the various species mentioned, and careful measurements and notes have been taken with a view to studying future changes. Present observations suggest that the *Juncus* will take advantage of the raising of the level of the mud by the *Spartina* and invade its territory."



GRAPH I. SHOWING INCREASE IN LENGTH AND BREADTH OF MAIN SPARTINA PATCH BETWEEN 1913 AND 1930.



GRAPH 2. SHOWING INCREASE IN AREA OF MAIN SPARTINA PATCH BETWEEN 1913 AND 1930.

Subsequent observations show that where the *Spartina* meets the advancing *Juncus* or *Leptocarpus* it penetrates for a short distance, but is dominated and suppressed by both indigenous species. The dense growth of the rush cuts off the light, and at the same time the presence of *Juncus* or *Leptocarpus* shows that the level is higher than the optimum for *Spartina*, while the mud is much firmer than suits *Spartina* best. It would also appear that *Scirpus americanus* is a potential dangerous competitor, favouring as it does muds rather softer than those on which the *Juncus* and *Leptocarpus* flourish. The mounded top of the main patch of *Spartina* has now been invaded by

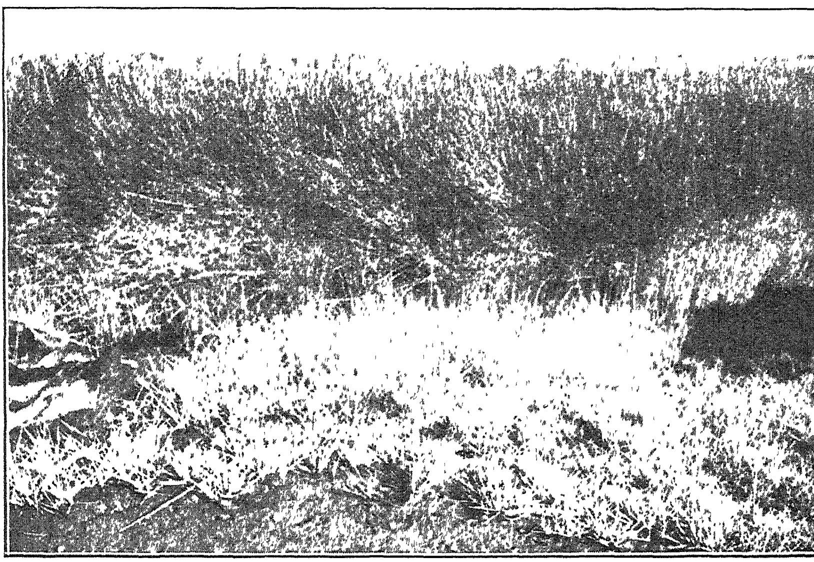


FIG. 5. SMALL PATCH OF SPARTINA COMING INTO COMPETITION WITH ADVANCING JUNCUS.

Juncus, apparently from seedling attack. There are now well established on it five clumps that have reached the flowering stage. Thus the higher parts of the patch appear likely to be dominated by the *Juncus*.

OTHER EXPERIMENTAL AREAS.

Numerous small clumps have been taken by Mr. Dalrymple and distributed for experiment elsewhere. Some of the localities are Kaitaia, Kaeo, Maharau, Kaipara Harbour, Kaukapakapa, Waiuku, Whangarei, Tauranga, Tutaekuri estuary, mouth of Hutt River, and Blind Bay. No definite reports are as yet available concerning the fate of these experiments, but it is hoped to secure and publish such later.

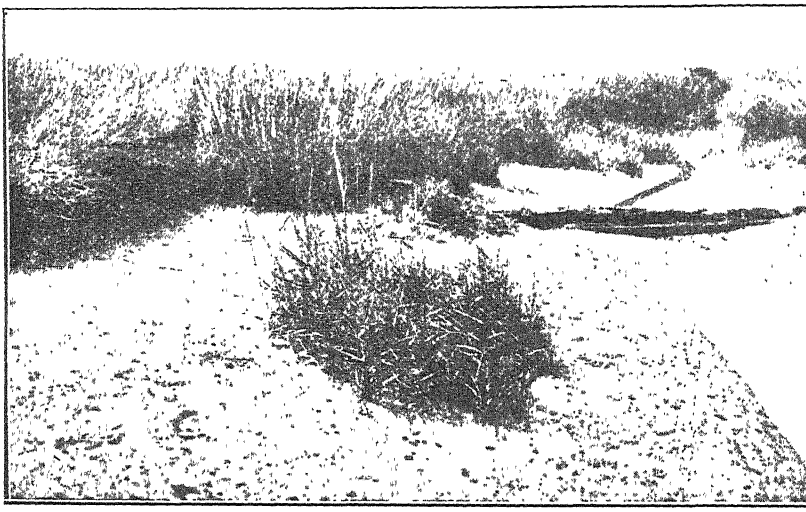


FIG. 6. SELF-ESTABLISHED PATCH OF SPARTINA IN FLOWER, FEBRUARY, 1930.
This patch was not in existence in 1926. Further patches are visible up channel.

CONCLUSIONS.

(1) *Spartina Townsendii* has definitely been established in New Zealand at Foxton.

(2) The growth during the past seventeen years has been very satisfactory, and the grass promises to play an extremely useful part on mud-flat areas.

(3) The optimum requirements for *Spartina* in New Zealand have not yet been thoroughly established. It is clear, however, that *Spartina* does not thrive in the more consolidated muds, nor above a certain level in relation to high tide.

(4) For rapid covering of an area extensive planting at regular intervals is required, as increase by seedlings appears to be rare, and increase by natural dissemination of clumps infrequent and irregular.

(5) Spartina will not hold its own in competition with *Juncus maritimus* or *Leptocarpus simplex*. Rather it prepares the ground for their more rapid extension. The best field for *Spartina*, therefore, is where there are extensive areas of bare soft mud-flat sufficiently below high-tide level to discourage the entry of *Juncus* or *Leptocarpus*.

REFERENCE.

ALLAN, H. H., 1924. Spartina-grass and its Introduction into New Zealand. *N.Z. Jour. Sci. and Tech.*, vol. 7, No. 4, pp. 253–256.

Gorse Parasite.—The utilization of a new design of breeding-cage by the Cawthron Institute has proved more successful with *Apion ulicis*, and the indications now are that the acclimatization of this gorse parasite, which up to the present has proved very baffling, will be eventually achieved.

ESTIMATION OF MOISTURE IN CHEESE.

METHODS RECOMMENDED BY THE DAIRY SCIENCE ASSOCIATION.

THE introduction of the manufacture of standardized cheese in New Zealand has made the chemical analysis of cheese a question of major importance. The opportunity was therefore taken at a recent inaugural meeting of the New Zealand Dairy Science Association to discuss the various methods of analysis in use in the dairy factories and grading-stores, with the object of finally formulating a method which could be adopted as a standard. As a result of the discussion, and partly on the basis of the figures submitted by Dr. F. H. McDowall, of the Dairy Research Institute (N Z.), the following procedure was drawn up and approved by the meeting.

SAMPLING.

The distribution of the three chief constituents of cheese — viz., casein, fat, and moisture — throughout a cheese, or throughout the cheeses from one vat of milk, is not uniform, due both to actual variations in the composition of the cheese as taken from the press, and also to the differences in the rate of loss of moisture by evaporation in the curing-room. It is therefore not possible to obtain a representative sample of the make of cheese from a vat by taking one plug from one of the cheeses with a trier. It was agreed that in order to avoid excessive plugging of cheese analysis should if possible be carried out on only one plug of cheese, and that the errors in sampling should be taken into account in a consideration of the analytical results. It was the opinion of the meeting that the standard position of sampling as adopted by the Dairy Division for use in the grading-stores should also be recommended for adoption in the dairy factories—*i.e.*, at a position on the circumference of the cheese one-third of the distance from one end. Not less than 1 in. of the cheese should be returned to the plug-hole.

Figures were quoted showing that a cheese-plug rapidly loses moisture on exposure to the open air, and it was agreed that plugs should be placed, immediately they were drawn, into a tightly corked sample tube or bottle. The tube should be kept in a cool place, away from sunlight, in order to prevent evaporation from the plug on to the side of the tube, and also running of fat.

PREPARATION OF SAMPLE.

It was unanimously agreed that a homogeneous sample could be prepared most satisfactorily from a plug of cheese by grinding rapidly to a paste in a glass or porcelain mortar, with subsequent cutting into small lumps with a knife and a spatula, and immediate transference back to the sample tube or bottle. For an accurate determination of the figure for fat in water-free solids it is essential that a homogeneous sample should be used for fat and moisture determinations—*i.e.*, after preparation of the homogeneous sample. *It should be kept in a well-corked bottle.*

A sample so prepared is somewhat difficult to introduce into an ordinary Babcock milk-testing bottle. When such bottles are being used the sample may be prepared by cutting the cheese plug into very thin strips, which are thoroughly mixed before the removal of a portion for determination of fat The cutting should be carried out rapidly, and during the process of cutting and filling into the bottle the cheese should be handled by means of forceps.

ESTIMATION OF MOISTURE.

The moisture estimation is best carried out in wide flat dishes of nickel or aluminium. Tall dishes of the type used for butter-analysis are not so desirable, since they do not permit free circulation of air over the surface of the cheese, and a longer time is required for complete removal of moisture.

In cases where dishes of approximately equal weight are used the dish must be counterpoised exactly before each estimation A quantity of about 5 grammes of cheese is suitable It is considered preferable to weigh approximately 5 grammes for the analysis, and to use a table for calculation of the results from the loss in weight Such a procedure involves admittedly two subtractions of figures as well as the noting of weights, instead of the method now in common use, where 5 grammes of cheese are weighed out and the figure of moisture content per cent. is obtained by a direct multiplication by 20 of the figure for loss in weight. The association considers that the loss in weight due to evaporation in adjusting the weight to exactly 5 grammes may often lead to inaccurate results.

It is important that the temperature and time of heating be carefully controlled. The greater portion of the moisture should be removed from the cheese at a temperature near the boiling-point of water, in order to prevent occasional loss of fat and curd through spitting. Where only one oven is available heating should be carried out at 100° C. (212° F.) during 1½ hours, and the temperature should then be raised to 115° C. (239–240° F.). The heating should be continued at this temperature for 4–5 hours. It is important that the time of heating should not be either too long or too short. In the one case the loss of weight is greater than that due to evaporation of free moisture from the cheese, and if the heating is not adequate free moisture will not be completely removed. It is not difficult to obtain results which agree closely, but the results may not represent accurately the moisture - content of a cheese if the time and temperature of heating have not been carefully controlled.

An alternative method, where an electric thermostatic oven is available, permits heating of the sample overnight. The samples are heated for 15 hours at 103° C. In this case preliminary heating at a lower temperature is not necessary, since spitting is not liable to occur at 103° C.

After heat treatment the dishes should be allowed to cool before being weighed. The dried cheese solids take up moisture slowly from the air. Hence it is advisable to transfer the dishes from the oven to a desiccator during cooling.

In places where electric power is available the association recommends the use of the Hearson thermostatic electric oven, which permits

the accurate control of temperature. Ovens made from an electric hot-plate and an oven compartment of galvanized iron are not considered suitable.

When the Hearson oven is being used to its maximum capacity the time of heating as above defined may not be sufficiently prolonged, as the dishes cover most of the holes in the oven-trays and prevent escape of water-vapour by restricting the natural circulation of air. Under such circumstances the perforated iron trays should be replaced by wire-netting trays.

—*N.Z. Journal of Science and Technology.*

UTILIZATION OF OCCUPIED RURAL LAND IN NEW ZEALAND.

—	*Year* 1928.	*Year* 1929.
	Acres.	Acres.
Orchards, market gardens, vineyards, nurseries, and seed-gardens	31,416	31,271
Field crops	1,689,369	1,746,200
Area occupied by residences, outbuildings, gardens, &c.	68,566	73,263
Fallow land	124,187	117,944
Sown grasses	16,871,530	16,855,512
Phormium tenax (New Zealand flax)	66,492	62,704
Tussock and other native grasses	14,091,717	14,131,630
Fern, scrub, &c.	3,976,134	4,016,774
Tree plantations—		
Conifers	200,513	252,052
Eucalypts and broad-leaved trees	31,570	41,849
Standing virgin forest	4,000,683	3,883,805
Barren and unproductive land	2,303,277	2,309,117
Totals	43,455,454	43,522,131

In this table " barren " land is defined as that which is incapable of being put to profitable use, and not merely that which is barren because unused. Types of this land are mountain-tops, cliff-faces, shingle-beds, &c. The table does not profess to give the condition of all land, as the total area of the Dominion is 66,390,262 acres, while, as shown above, the area occupied in 1929 was returned as 43,522,131 acres—a difference of 22,868,131 acres.

—*Census and Statistics Office.*

Distribution of the Ragwort Moth.—The Chairman's report to the February meeting of the Research Council contained the following reference to this subject: " The Director of the noxious weeds research has been engaged upon the liberation of as large supplies as possible of eggs of *Tyria jacobaeae* to the badly infested ragwort areas. In order to secure the best results the distribution has been arranged through district officers of the Department of Agriculture; and reports to hand indicate that the moth is becoming well established wherever it has been liberated Unfortunately, supplies of pupæ of *Tyria jacobaeae* received from Farnham Royal have not been in such good condition this year, owing to the unfavourable English summer conditions, and in consequence a lesser number of eggs has been available for distribution than was originally hoped for. The persistent rain that has been characteristic of this New Zealand summer has also delayed progress to some extent."

SEASONAL NOTES.

THE FARM.

Pasture-management.

THE season has been of such a nature that in many districts where a fair amount of autumn rain usually falls it will be found highly advisable to "top" the pastures with the mower during the early autumn, in order to remove patches of long, rank, mature growth. The removal of these patches results in the development of a valuable, even, fresh growth when adequate moisture has been provided by rain. If in early autumn suitable dry stock are available to consume the coarse growth that calls for removal, then the mowing just mentioned can be dispensed with. It is gratifying that more and more farmers, judging by their practice, are becoming convinced of the value of mowing pastures on which stock have failed suitably to control the growth. The proper pruning or cutting-back of pastures, whether it be by animal or mechanical means, will in the future be a most influential consideration on thousands of farms, because it will lessen or remove the necessity of providing high-producing stock with concentrated feeds or special forage crops.

Autumn harrowing of the pastures is a valuable practice which is rightly growing in popularity. At this season harrowing has a twofold purpose. In the first place it effects distribution of the animal-droppings, which tend to accumulate during the dry summer period in which it is often inadvisable to harrow. These droppings, which, if undisturbed, do injury to the pasture, are a source of valuable fertilizing material when effectively scattered. In the second place, grass-harrowing should be considered and made a form of cultivation. The sooner it is popularly realized that grass, like other crops, responds to cultivation, the sooner will suitably severe harrowing be looked upon generally with favour rather than with misgiving. Up to the present the cultivation generally given our grassland by harrowing has been too light rather than too severe. Grassland is likely to specially respond to autumn cultivation because in the autumn certain valuable pasture species tend to develop a fresh crop of feeding-roots. Surface cultivation, by pulverizing the soil, occasions the conditions favouring vigorous development of these valuable feeding-roots.

Autumn Top-dressing.

Much grassland can very profitably be top-dressed in the autumn. Autumn top-dressing tends to give a greater supply of winter and early spring feed, and to avoid to some extent the excessively heavy growth in late spring and early summer, a growth which on many farms it proves awkward to deal with effectively. Hence, autumn top-dressing tends to beget a more even grass-growth throughout the year; and a more even grass-growth is in many instances a step towards easier farming and cheaper production.

The manures that principally call for attention are the phosphatic ones. Of these, superphosphate is the most widely used, and this preference for super is probably sound practice. Super will give successful results where the rainfall is too low for success with the other phosphatic manures, and where the rainfall is high it will on the average quite hold its own with the other phosphatic fertilizers. This is particularly the case on farms where the practice has been adopted of top-dressing each paddock every season. In certain districts splendid results have been obtained with basic

slag. When this is the case farmers should not lightly depart from slag except in a trial way, especially if there is not a great deal of difference between the price of high-grade slag and of 44–46 per cent. super. Provided relatively quick action is not desired, the African and similar phosphates deserve consideration in districts of good rainfall. Under many circumstances a mixture of equal weights of these phosphates and 44–46 per cent. super can be depended upon to give good results on grassland.

It is usually advisable to apply top-dressing early to newly established pastures. The object is to obviate any possible deterioration that would arise from somewhat low soil-fertility. In this connection the wisest attitude to adopt in respect to deterioration is "prevention is better than cure."

Wheat-growing.

For wheat a well-drained soil is desirable, for it allows the natural deep-rooting habits of the crop to be followed. In the cropping system one of the best places for wheat is after peas, tares, or red clover. These crops normally leave the ground in a friable fertile condition, so that a good crop is ensured with a minimum of cultivation and manure. Another favourable cropping order is wheat after rape. After rape the land is easily worked, available at the right season, and the manure applied with the rape may be expected to be of some benefit to the wheat. Growing wheat after pasture is frequently practised, and gives good results provided special attention is given to thorough cultivation. Wheat may also often very suitably be grown after potatoes. These, if dug as soon as they are ripe, will leave the ground clear early enough for the wheat, which can be sown with the minimum of cultivation and yet with excellent prospect of a good crop.

Wheat needs a fine but firm seed-bed. The necessity for firmness sometimes makes it possible to dispense with ploughing after peas or potatoes, the wheat being preceded merely by two or three diskings. It is not desirable to work the surface soil too finely, for the fine particles have a tendency to cake. Small lumps are an advantage, provided they are on the surface; they give the seedlings shelter during the winter and gradually break down into a desirable fine loose surface. When wheat is to follow grass or clover, skim-ploughing should have been done before this matter is published. If not, it should be pushed on with as urgent work. About six or eight weeks after the skim-ploughing it is advisable to disk the surface to a fine condition and then plough to a depth of 6 in. This puts finely pulverized material to the bottom and clods to the top, where they can be broken up suitably with harrows, &c. Especially when the preliminary cultivation is being done somewhat late it may not be advisable to use the spring-tooth cultivator, because of the danger that it may bring to the surface the vegetation that has been buried. By commencing cultivation early enough this ploughed-down grass-growth is given time to decay, to blend with the remainder of the soil, and to contribute to the food-supply of the crop. When wheat is sown after rape, peas, or potatoes the skim-ploughing and the first disking may be omitted. When wheat follows oats or wheat the stubble should be first disked or grubbed, and to obtain a fine tilth should later be ploughed to a depth of 5 in. or 6 in. When wheat follows grass or another grain crop there is always the danger of grass-grub infestation.

In the main South Island wheat-growing areas spring sowing should be practised only when circumstances necessitate it; autumn and early winter constitute the ideal sowing season. In the most southerly wheat areas and in the North Island spring is usually the most profitable sowing-period.

Of the standard wheat varieties, Hunter's, Pearl, and Velvet call definitely for autumn or early winter sowing; Solid-straw Tuscan may be sown

in the spring as well as in the autumn or early winter In the North Island Jumbuck, Major, and John Brown have won most favour for spring sowing

Extensive official trials have indicated that over a wide range of country it proves distinctly profitable to use with wheat 1 cwt of superphosphate to the acre, in twelve Canterbury trials 1 cwt of super gave an average increase of 6 bushels to the acre, and in no instance was the increase in yield too low in value not to show a profit after paying for the cost of the superphosphate. In Canterbury last season three out of every four growers used manure on wheat at the rate of slightly over 1 cwt to the acre

Previous completed official trials over extensive areas suggest that in many instances it will prove profitable to dress wheat in the spring with about 1 cwt of sulphate of ammonia to the acre Trials of the past season which are now being completed promise to confirm the spring use of sulphate of ammonia with wheat as a worth-while practice. Attention will be directed to the results of these trials as soon as they become available There is no evidence to support the autumn use of sulphate of ammonia with wheat when sowing in the autumn

Control of Cereal Diseases.

One of the wheat-diseases that particularly requires the farmers' attention is covered or stinking smut. When this disease occurs a dark-brownish mass, which sometimes has a strong smell, fills the skin that in ordinary circumstances would hold the healthy grain Infection of stinking-smut is effected through the disease being deposited on the outside of the wheat grain Hence practically any line of seed is liable to become contaminated with the disease, even though it comes from a crop that was free from disease. Every travelling threshing plant is likely to freely spread stinking-smut, and because of this, even when a farmer is saving his own seed from a crop which was free from disease, it will be very advisable for him to take preventive measures.

The best means of controlling stinking-smut is by dry-dusting the seed wheat with fine copper-carbonate powder at the rate of 2 oz. per bushel. This can be done satisfactorily only by those farmers who have a proper dustproof mixing-machine, because the powder is harmful if breathed in to any extent. The dusting is being done by certain merchants who have installed equipment for dealing cheaply with seed in bulk. The advantages of the copper-carbonate treatment is that while it is very effective it involves no danger of injury to the seed, it calls for no handling of wet seed, and it can be done at any time, for treated seed may be kept without suffering damage.

If the copper-carbonate treatment cannot be adopted, pickling with formalin is the next best practice In the case of wheat, one effective way of carrying out formalin pickling is as follows. Prepare a formalin solution at a strength equivalent to 1 pint of good formalin to 60 gallons of water; wet the seed thoroughly with this solution by sprinkling it over the seed and then shovelling the seed backwards and forwards on the clean floor of a shed. Then pile the seed into a heap, cover the heap with sacks soaked in a formalin solution of the strength already mentioned, and leave the heap covered with the sacks overnight. The seed should be sown while still damp; if it dries out a considerable loss in germination may result. Do not put the treated seed in sacks which may be infected with the disease, but in the sacks which have been soaked in formalin solution.

The following is another effective way of pickling wheat: Prepare formalin solution at a strength of 1 pint of formalin to 40 gallons of water. Have sacks one-third full of seed, and their openings sewn, not tied. For ten minutes immerse each sack in the solution, keeping the grain well agitated in the sack by lifting one and then the other.

corner. Then throw the sacks on ground where there is no danger of freezing, and spread the grain evenly by flattening out the sacks Do this overnight, and the seed is ready for sowing the next morning. The seed cannot be kept long without damage This and the previously-mentioned method of pickling seed is recommended by Mr J. C Neill, Field Mycologist, who advises further that it is necessary to sow about 25 per cent. more seed when the formalin treatment is followed than when copper-carbonate treatment is used

The second pickling method—the dipping of the sacks containing the seed in formalin solution, 1 pint to 40 gallons—can be used effectively for oats and barley Very rightly the pickling of seed oats and barley is receiving much more attention than it did a few years ago. Oats-seed should be pickled even though the crop is intended only for the production of chaff If not pickled, smut will possibly not only cause serious loss of grain, but also discoloration of the whole of the chaff. Despite a common belief to the contrary, Algerian oats are just as subject to smut as other varieties. Barley is perhaps most neglected. It will prove profitable as a general rule to pickle all barley-seed sown—malting, Cape, and Black Skinless

Bluestone treatment is being generally discarded because of the extent to which it both lowers the seed-germination and weakens the seedlings which do germinate.

General Forage-crop Work.

Arrangements should be made to utilize such crops as maize and millet during April, this being preferably done during the first half of the month. If swedes have suffered a serious attack of dry-rot they should be fed off without unnecessary delay When barley and oats are to be utilized for green feed, better results are secured by making two or three feedings-off, commencing each when the growth is not very high rather than waiting until there is a tall growth If the crop is fed off several times when relatively short undue waste by trampling is avoided, and the fodder is better balanced and more attractive than when more mature.

Quite often after the last cut of the season lucerne is grazed and the ground considerably trampled. This practice definitely favours the invasion of grass weeds and is usually inadvisable, especially in districts of good rainfall where the invasion of grass is one of the worst troubles in respect to lucerne.

Oats for winter and spring feed and subsequent grain-production should be sown not later than April or early in May Generally they respond profitably to an application of 1 cwt. to 2 cwt per acre of phosphatic manure in which superphosphate is prominent. The proved strains of Gartons may be regarded as the best all-round oat for the South Island. Gartons will not stand feeding off in the same way as Algerians or Duns , they should be fed off once only, and quickly. Algerians, which are best autumn sown, are rightly popular as a green feed ; they can be fed off both in autumn and spring, and provide good chaff. Dun oats must be autumn-sown. Usually they make little growth till early September, and then can be fed off several times in the spring.

The initial ploughing of land intended for lucerne and mangels can often advantageously be carried out in autumn, provided the land is not required for some other purpose By commencing cultivation work early one is often able to destroy many weeds which if not removed would be a danger to the success of both these crops.

When a lucerne-field has become infested with weeds April is an excellent month in which to carry out cultivation to deal with the invaders. If a spring-toothed cultivator is used it should be fitted with narrow tines, otherwise a good deal of damage may be done to individual lucerne-plants

in working the ground enough to dislodge the weeds it is desired to destroy. The use of disks in the cultivation of lucerne is not recommended, because their cutting-action soon results in an undesirable thinning of the plants. It is sound practice under most conditions to follow the cultivation of the lucerne immediately by sowing a bushel of Algerian oats. This sowing of oats with lucerne gives a heavy growth which has a well-balanced supply of nutriment, and which may be made into splendid ensilage in the early summer. It should be definitely planned to make the mixture of oats and lucerne into ensilage, or to use it otherwise early in the season. If the mixture is utilized for the production of hay to be made when the weather is suitable, it is apt to be left unmown so late as to do considerable damage to the lucerne crop by the shading caused by the oats.

—*R. P. Connell, M.A., Fields Division, Palmerston North.*

THE ORCHARD.

Spraying and Disease-control.

As the crops approach maturity the spray programme will gradually taper off, but the late-ripening varieties will still require attention for mealy bug, red mite, and fungoid diseases. With the dry hot weather red mite will increase rapidly, and trees from which the crop has been picked are often overlooked, allowing this pest, mealy bug, and other insects to continue their depredations and complete their breeding-season without interruption. The consequent loss in tree-energy may be sufficient to cause premature defoliation and adversely affect the next season's growth, as well as necessitating a heavy dormant spraying to destroy the eggs prior to commencement of next season's growth. Judicious applications of summer oil sprays will lessen the number of overwintering eggs, and so reduce the infection that further control may not need consideration until hatching commences in the spring, when a much lighter application will be as effective as the heavy mixtures required for dormant dressings. The practice of applying a fungicide to storage varieties prior to picking has much to recommend it. Black-spot, bitter-rot, and other fungoids will continue their development in storage, and the pre-storage spray may save loss and disappointment in packing out.

Where brown-rot has been prevalent time would be well employed in cutting out twigs or shoots which have been killed by the fungus spreading through the fruit-stalk, girdling the shoot, and forming cankers. These cankers are potential sources of infection during succeeding years, and can be located easiest while the foliage persists. Silver-leaf infection should be cut out before growth ceases, and if taken in time and the diseased portion removed below the infection the life of the tree may be extended. All exposed surfaces should be thoroughly coated with tar or paint as a protection against reinfection by spores. Where the infection is general recovery cannot be expected, and the tree should be dug out and burned. The complete destruction is important, as the spores are produced after the wood has been killed, and any stumps left will be disseminators of the disease.

Picking for Storage.

Fruit intended for storage should be picked as it attains the necessary degree of maturity, care being taken to leave those fruits which are backward in condition for later pickings. The necessity for careful handling cannot be overemphasized, for rots will develop in damaged skin and endanger neighbouring fruit. For home storage where space is limited and

close stacking in cases is necessary it is advisable to segregate each variety, so that their order of ripening can be checked and each used as condition demands. Laths placed between the tiers of cases parallel to the draught will improve the air-circulation and aid the dispersal of gases thrown off during the ripening process. Free circulation of air in the storage-room, which should be kept cool, is important, and excessive moisture is to be avoided

Preparation of Land for Planting.

This work should be proceeded with as early as possible, in order to allow ample time for soil-aeration before the autumn rains commence Ploughing in strips about 5 ft wide and two furrows deep where the tree rows are to stand will be an advantage; the remainder of the land may be left for working in the usual routine if desired. Where the subsoil is retentive it is essential that the ploughing should follow the fall of the land, so as to remit the free drainage of excess water from the root area, and the work can be done more satisfactorily while the soil is comparatively dry than when wet Early preparation is conducive to early planting, and as root-development commences prior to movement in the top it follows that the stimulation of the early root movement will hasten the establishment of the tree and ensure satisfactory growth during the first season.

Citrus Culture.

This period, while the crop is developing, is a good time for general overhaul of the trees, thinning out exhausted wood, cutting out suckers or water-shoots, and trimming the lower fringe to raise the foliage to about 18 in. above the ground. It may be necessary to remove banked-up soil from round the trunks to minimize the danger of collar-rot The trunk should be exposed to the normal level, and the soil removed over an area sufficiently wide to avoid the possibility of forming a basin which would hold water and produce conditions inimical to the health of the tree. Citrus-trees are impatient of wet conditions, and any low areas from which surplus water does not drain rapidly should receive attention, either by laying a permanent drain or by opening furrows between rows and providing ready escape for the water.

If necessary, spraying for scale-control, using oil 1–60, should be completed before growth ceases. Oiling when the trees are dormant or in a sickly condition will result in defoliation. Oranges may require an arsenate-of-lead spray to control caterpillars. Citrus brown-rot infection may be expected to appear when the autumn rains commence, and bordeaux, 4-4-40, should not be neglected. The infection from this disease is upward from the ground, and many growers are content to spray only the lower 6 ft. or so of the tree, but the application must be thorough, and later applications after rains are advisable.

Cover-crop sowing should not be delayed, and any quick-growing leguminous crop which will make a good bulk of growth is to be preferred. A dressing of manure to stimulate growth should be applied at the time of sowing. If sheep or pig manure is obtainable a liberal application will be beneficial, but it should be applied in the vicinity of the outer fringe of the foliage and not heaped around the stem. Some discrimination is required in the use of cow-manure. In some localities it is not uncommon to find the soil reduced to an adhesive soggy mass, and the trees slowly dying through the too liberal use of fresh manure. All animal-manure should be well rotted before use.

—G. H. McIndoe, Orchard Instructor, Gisborne.

POULTRY-KEEPING.

Right Housing and Exercise for the Pullets.

FRESH eggs usually command their highest level of value during the month of May. The present position of the market indicates that the forthcoming first months of winter will be no exception to this rule, as the great majority of the adult birds will be undergoing the moulting process and be in an unprofitable condition, and the pullets must be principally relied upon for the egg-yield. In anticipation of cold winter weather, when everything is against a bird producing to its fullest capacity, it only stands to reason that the pullets must be provided with the best conditions if eggs in good numbers are to be secured

The first essential in this respect is to make the young birds comfortable, as only in this condition can they be expected to do their best This implies a roomy house, with an open or partly open front as the means of admitting sunlight and fresh air—those great essentials to the well-being of the domesticated fowl There must be no cracks in the sides or back walls. as these create a draught and cause roup and other troubles With the open or partly open-fronted house the birds can be fed inside in comfort during bad weather Obviously a bird cannot be expected to lay well if compelled to wait about in a muddy yard with wet plumage for its evening meal to be thrown down By feeding the birds in the house a dual form of economy is brought about Firstly, only a minimum amount of food will be required to maintain the bird, as when it is fed in the rain body heat to dry it and ward off the cold must necessarily come from the food eaten. Secondly, there is a great saving effected in protecting the grain from sparrows and other small birds. It is safe to assume that on many plants the money saved in this way in one year would more than compensate for the cost of making the houses of sufficient depth to confine the birds and feed them under cover.

Provision for exercise is also essential if a bird is to produce heavily at this period of the year. Hence the whole grain ration should be fed in deep litter, in order that the birds may be kept busy in scratching for the hidden grains In short, every endeavour should be made to discourage the birds from resting on their perches by day, as this is apt to cause an overfat condition—a state which does not tend towards promoting heavy egg-production. This does not mean that the ration should be reduced in order to check a production of surplus fat On the contrary, it means liberal feeding, but by a method which ensures that the birds are made to work to secure at least the greater part of their food In the long nights of the winter months the birds have ample time to rest without doing so during the day. The heavy-laying hen is always a busy bird, and if denied the opportunity of keeping in this condition she will fail to be really profitable.

Prevention of Colds.

I cannot urge too strongly the necessity of taking every precaution against colds, which young birds especially are liable to take at this season of the year It should be borne in mind that once a flock of pullets becomes affected with colds their egg-yield rapidly declines, and in spite of all that is done for them they will bear an unkempt, miserable appearance. Thousands of winter eggs are lost annually from this cause. Not only this, but colds are the forerunner of roup, and once this dreaded disease gains a foothold in a flock heavy mortality is almost sure to eventuate. The best of all means of dealing with colds is to prevent them. The most common symptoms of colds are sneezing, eyes watering, and a discharge from the nostrils, to which dust and dirt adhere In severe cases the discharge will usually be found on the feathers under the wing, owing

to the bird sleeping with its head thereunder When birds show any of these symptoms they should be isolated at once as a prevention against the trouble spreading. The next step should be to find the cause and remove it, and for this purpose it is a good plan to visit the house by night It may be found that the ventilation is insufficient, or that there are cracks in the back or side of walls whereby the birds are sleeping in a draught, which undoubtedly causes more outbreaks of cold than anything else. Usually when colds make their appearance the poultry-keeper resorts to one of the many cures recommended for this trouble, and quite overlooks the great essential of first discovering and removing the cause. Obviously, if the cause is not removed the trouble is apt to recur at any time As to a cure, or rather a means of checking the spread of colds, it is a good plan to place some Condy's crystals in the drinking-water, sufficient to give it a pink colour. For well-developed colds dip the bird's beak into pure kerosene sufficiently deep to cover the nostrils, and hold the bird in this position until it inhales, repeating this treatment on alternate days This will usually effect a cure, but, as mentioned, if the cause is not found and removed the trouble is likely to recur

Food Quality and the Ration.

Particularly at this season of the year, when the egg-yield may be regarded as more or less artificially produced, the poultry-keeper should make sure that the food supplied is of the best possible quality, quite irrespective of cost With any class of poultry it is always poor economy to feed damaged or musty food because it is cheap Especially is this the case with pullets which are being looked to to produce dear-season eggs They will simply refuse to eat such food (unless, of course, forced to by hunger), and obviously a declining egg-yield will result At the present ruling price of eggs it will pay to feed nothing but the best, and as much of it as the birds can consume There is no danger of overfeeding the laying bird with food of the right quality, provided she is given ample opportunity for exercise.

The morning mash may consist of one part of finely ground good-quality wheatmeal to two parts of bran. This should be made as appetizing as possible by moistening it with meat, soup, skim-milk, &c When these liquids are not available boiling water should be used. A mash moistened with the latter will be much better relished by the birds than when cold water is used. Feed only what the birds will pick up in, say, twenty minutes If mash is left before them at all times they will eat this and fail to take the necessary exercise by scratching for the grain ration in the litter, in which there should be odd grains for the birds to fossick for. In the evening, and well before dark, give a full meal of grains, such as equal parts by measure of wheat, maize, and oats. It is always a good plan to give more at this meal than the birds require, as what is left will induce them to scratch and keep busy. If it is observed that one of the grain foods mentioned is being left it should be fed in a reduced quantity. In order to secure a high winter egg-yield a forcing element must also be included in the ration. This denotes highly nitrogenous substances such as meat, meat-meal, milk, &c. If, however, it is observed that ovarian troubles are making their appearance, and that many shell-less or double-yolked eggs are being produced, the forcing diet should be reduced accordingly, as these troubles indicate that the birds are eating more of the forcing-food than is good for them. It goes without saying that if the birds are to do their best sharp gravel grit, crushed oyster-shell, clean water, and a liberal supply of green food should also be provided.

Finally, I would emphasize the great importance of doing everything possible to prevent the pullets bred to lay in winter going into a false moult. This is usually due to insufficient or inferior food, and to

changes in the system of feeding, as well as that common cause change of quarters Obviously, no experimenting should be attempted, but rather should uniform and regular attention be observed in the poultry-farmers' methods.

—*F. C. Brown, Chief Poultry Instructor, Wellington*

THE APIARY.

Preparations for Winter.

THE time is at hand when it is of paramount importance that proper preparation be made for winter in the apiary If the colonies are to winter in good order, so as to escape the abnormal losses which sometimes occur, then it behoves the beekeeper to attend to the leading factors that ensure successful wintering The attendant evils of neglect are starvation, spring dwindling, and poor colonies, these latter being of little account when the next season's flow arrives. Among the most important factors which make for success are a strong cluster of bees, a good queen, plenty of good stores, and protection.

Strong Clusters.—It is safe to say that too little attention is paid to wintering the colonies with strong clusters of young bees. Having secured a crop of honey, and noting that the colonies are strong in bees, the beekeeper is often satisfied to trust to chance. At the close of the season the colonies are likely to contain a large force of bees, but the majority, having helped to gather the season's crop, are old, and in consequence cannot be taken into account in wintering. As a result, unless large numbers of young bees are being raised to take the place of the old stock, the colonies will seriously dwindle in the spring or become a total loss in winter. Every effort must be made to keep up breeding well into the winter, and it is often advantageous to stimulate the colonies by autumn feeding.

Good Queens—Next in importance is the necessity for the colony to be headed by a good queen. Too little attention is paid to superseding failing queens A queen that has laid vigorously during the honey season is likely to become worn out and her powers of reproduction diminished In all cases these queens should be replaced and a vigorous young mother supplied. It often happens that the bees recognize a failing queen and set to work to supersede her, but this work should be anticipated by the beekeeper Other things being equal, stocks headed by a vigorous mother are likely to keep up late breeding, with a result that the colonies will come out in the spring with a prolific queen, and the bees attendant upon queenless hives will be greatly diminished.

Ample Stores.—If the beekeeper studies his interests and the welfare of his bees he will ensure that every colony goes into winter quarters with plenty of good stores. This is a most important factor, and upon it depends largely the staving-off of starvation which faces the bees during the months which follow. The colonies that are supplied with honey winter safely, build up early in the spring, and are ready to take advantage of the nectar from the early-flowering plants. Beginners often ask how much honey should be left for the bees to winter on. The amount necessary must to some extent depend largely upon locality, and care must be exercised, more particularly in the South, to provide sufficient food so that winter feeding may not have to be resorted to. In the North winter feeding may be successfully carried out, as there is not the same risk in breaking up the clusters as there is in the extreme South. In no case should a colony be left with less than 30 lb of sealed honey, and it is wise to increase this amount to 40 lb. Abundance of stores is essential if winter losses are to be eliminated altogether.

Protection.—Another important factor in safe wintering is that of protection. This may be provided by housing the bees in good watertight hives, and protecting them by good shelter-hedges or fences. Great winter losses occur every year in this country through lack of attention to the hives, more particularly to the roofs. Leaky roofs are an abomination, and should not be tolerated under any circumstances. By allowing the roofs to leak the mats and hives become damp, and the consequent drain on the stores is largely in order to keep up the heat of the cluster for safe wintering. It is safe to state that where the bees are kept dry the amount of food consumed to keep up the heat of the cluster will be small as compared with the stores eaten where proper protection has not been afforded by the beekeeper. New Zealand in general being a wind-swept country, it behoves the beekeeper to see that the bees are located in a sheltered position. Cold winds militate against brood-rearing, and also prevent the bees from taking a cleansing flight during the spring months.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

The Tobacco Crop.

LAST month's notes dealing with handling of the late crop have now a special application while the last of the crop is being harvested. The process of curing is a very delicate operation, and great care and attention is required to turn out good leaf at this season of the year. The leaf is very sensitive to changes of temperature and humidity, and adverse conditions quickly spoil its texture, colour, and aroma. Only by the closest attention to detail now may these qualities be obtained and preserved at their best. To leave well-cured leaf exposed to adverse conditions for even a short time results in serious damage. Its bright colour is lost, and a spongy condition of the leaf is acquired. Also the conditions in the bulking-room must be up to requirements, or the finest cured leaf will be spoiled. A wooden floor that is damp through being near the ground and unventilated has often caused serious loss through moulds developing. The same thing happens when any decayed organic matter is present; the pleasant aroma and flavour is lost and a musty flavour is acquired. As before stated, the room in which the bulks are made must be sweet, clean, dry, and free from sudden changes of temperature. The leaf will then not only retain its desirable qualities, but greatly improve with two or three years of such storage.

Planting of Small Fruits.

Preparation of the land for planting these fruits should be completed as soon as possible, so that the ground may be settled down before planting commences. A good dressing of organic manure should be turned well under, with a dressing of bonedust and basic slag to follow. Black currants prefer a cool moist position, and are best planted 3 ft. to 4 ft. apart in the rows with 6 ft. to 8 ft. between the rows. Raspberries require similar conditions; 1 ft. between the plants and 5 ft. to 6 ft. between the rows is good spacing. Gooseberries and red currants require a more open position, and are best planted 5 ft. to 6 ft. apart both ways. Where plants have to be purchased they should be carefully selected now, and arrangements made for delivery as soon as they are ready for removal—about the month of May.

In the warm climate of Auckland it is said to be inadvisable to plant out strawberries before the month of May, but in most districts it is best to plant them as soon as possible now, so that they may become established

before the cold weather There is one point of special importance in connection with this subject, and that is the utter futility of planting small fruits in land that is infested with "twitch" or similar bad weeds. It is not uncommon to find this done The eradication of these weeds is difficult when the land is clear of crops, but it is impossible to do it after planting They may not then even be controlled, and the result is a serious loss The mistake is generally made, of course, by people with little experience, but they are usually those who are least able to afford it.

The Market-garden.

In most districts late crops of potatoes and onions should now be harvested . great damage is sometimes done by allowing them to remain after they are mature and a second growth has commenced. Spring-sown carrots also should be lifted before they are spoiled by cracking Beet, parsnips, and autumn-sown carrots are often allowed to remain in the ground until a favourable market demands them.

During the month of April a piece of good land in a warm sheltered position should be chosen for planting out spring cabbage and cauliflower sown in seed-beds a couple of months previously This is usually a valuable crop and worth careful attention To avoid the attack of slugs and other insect pests it is often advisable to destroy them before planting by broadcasting a bait composed of 1 lb. of Paris green and 28 lb of bran thoroughly mixed in a dry state and afterwards made damp with water Broadcast lightly of an evening it is a very effective remedy If this is followed with a dressing of lime, the ground may be marked out and planted with every prospect of success.

Seed-beds of lettuce, main-crop cabbage and cauliflower may be sown now for July planting , they should be sown thinly and the lettuce given some shelter in rough wet weather, or rust disease may be troublesome. In cold districts these sowings would be more satisfactory under cold frames.

Asparagus-plants should be cut down to the surface of the ground, and burnt as soon as the foliage ripens and before the seeds fall. A good dressing of well-decayed organic manure and 3 cwt. of kainit per acre turned in would now be very beneficial. Where new beds are to be made in the spring, commence now by giving the land thorough preparation by cleaning it, giving deep cultivation and turning in a heavy dressing of organic manures or cover-crop A sandy loam, moist but well drained, is very suitable for extensive planting.

Hedges and Shelter Belts.

This subject is of special interest to all who have to do with gardens or orchards of any kind, as suitable shelter is a wonderfully big factor in successful cropping. The land to be planted should be cultivated and cleaned as a rule, and indeed kept so for a year or two until the plants are established Plans for this should now be prepared and the ground prepared for planting in May. Poplar and privet, planted alternately and close, makes a most efficient breakwind in rich moist ground ; or the privet may be replaced by barberry. For a higher evergreen shelter-belt, *Cupressus—Lawsoniana* or *sempervirens*—planted 2 ft. apart, requires comparatively little attention, and is most satisfactory on average land.

—*W. C. Hyde, Horticulturist, Wellington.*

Relation of Electricity to Agriculture.—A committee has been specially set up by the Research Council to investigate the possibilities of utilizing electricity to a greater extent in agriculture. At present relevant data are being secured from a wide series of sources, and the position is being explored with a view to the issue of a report in regard thereto as it affects New Zealand.

WEATHER RECORDS: FEBRUARY, 1930.

Dominion Meteorological Office

GENERAL NOTES.

In contrast to the preceding month, February was very dry over the greater part of the Dominion The whole of the South Island, with the exception of Puysegur Point, had a low rainfall, the deficiency being greatest in the North Canterbury, Marlborough, Nelson, and Westland Districts. Most of the North Island also experienced less than the average, but a considerable excess was recorded in the east coast portion from Poverty Bay northwards and throughout the Auckland Peninsula This effect was brought about by a predominance of south-easterly winds which were associated with cyclones passing to the north of the Dominion

Even in those districts where rain was scanty the growth of grass was well maintained throughout. The effect of the lack of rain was small, owing to the heavy falls in previous months, to the absence of drying winds, and to the cool and somewhat changeable weather which prevailed Conditions were, indeed, at times, more of a spring than a summer type.

On the whole the month was favourable to all classes of stock Dairy herds have milked well, and sheep and lambs have thriven in most districts. Reports indicate good crop yields, but the absence of warm sunshine has caused harvesting to be much later than usual. In many districts root crops have done remarkably well, the weather having been most favourable to this class of crop.

The mean temperature was again markedly below normal, for although there were many warm days the nights were invariably cool.

The pressure systems responsible for periods of unsettled weather were mainly cyclonic in form. The Auckland, Bay of Plenty, and Poverty Bay districts experienced considerable rainfall between the 1st and the 5th, while a cyclone was located to the north-east of Cape Maria van Diemen. This disturbance passed rapidly away on the night of the 5th, and from then on to the 13th the dominating influence was a slow-moving, fairly intense anticyclone. Except in the areas and during the period mentioned, fine weather of unusual brilliance was experienced over the Dominion until the 13th

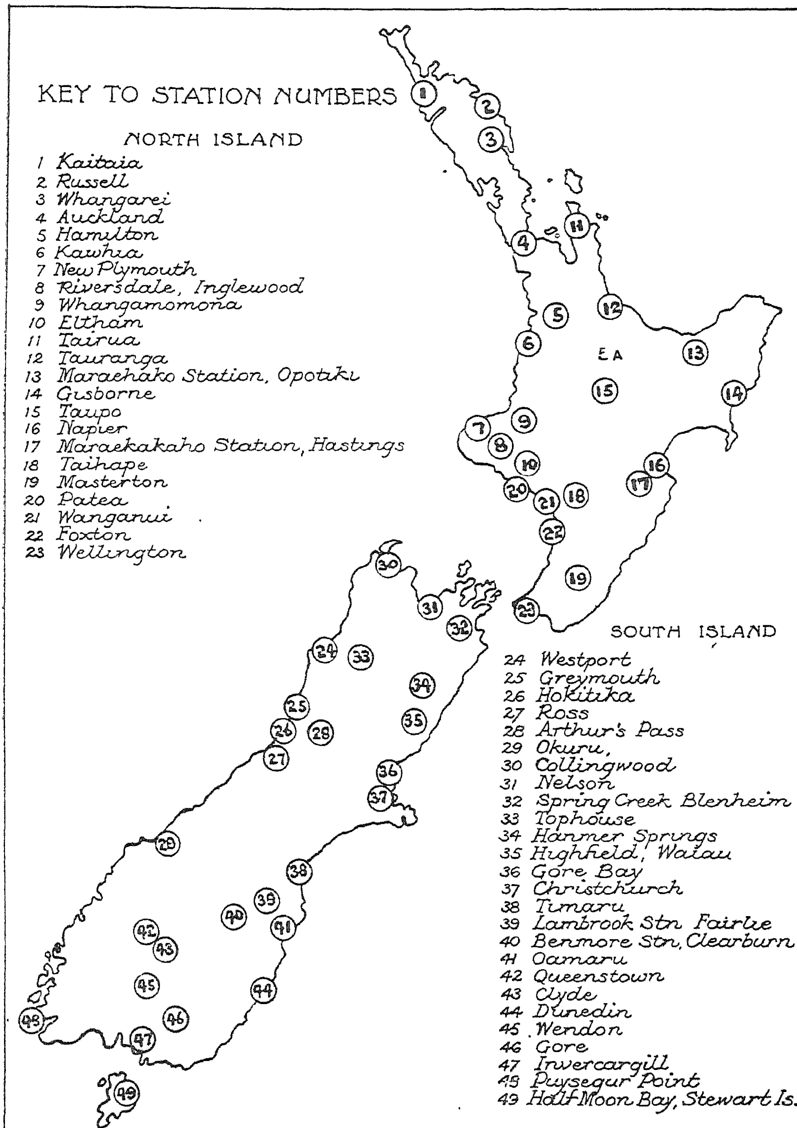
Only two depressions of the westerly type were recorded during the month, one on the 16th and the other on the night of the 23rd. The former followed closely on a cyclone which had moved gradually across the northern Tasman Sea and crossed the North Island during the night of the 15th Heavy rain was associated with this cyclone in the North Island on the 13th, 14th, and 15th, more especially in the northern and east coast portions, where some flooding occurred at places. The observer at Maraehako Station, in the Bay of Plenty, measured 11 in. of rain on the 15th

A second very fine spell set in on the 25th and continued to the close of the month. At this time there was evidence of an intense tropical cyclone operating to the north-east of New Zealand. It was too far away to have any general unfavourable effect on the Dominion's weather, but some scattered rain fell in the Auckland and East Cape districts, and on the afternoon of the 28th a severe thunderstorm occurred in the neighbourhood of Taumarunui. A house at Te Koura suffered considerable damage by lightning, the veranda collapsing and the front of the house being scorched.

RAILFALL FOR FEBRUARY, 1930, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
	North Island				
		Inches.		Inches	Inches.
1	Kaitaia ..	6·46	7	5·04	2·95
2	Russell ..	6·32	7	2·28	3·20
3	Whangarei	6·20	9	2·32	4·46
4	Auckland	6·66	11	3·28	3·06
5	Hamilton	2·47	9	0·98	2·96
5A	Rotorua	2·27	9	0·95	3·85
6	Kawhia ..	4·38	11	1·23	2·66
7	New Plymouth ..	2·99	9	0·95	4·00
8	Riversdale, Inglewood	5·56	9	1·46	6·30
9	Whangamomona ..	4·34	10	0·88	4·23
10	Eltham ..	1·89	7	0·64	3·37
11	Tairua ..	11·36	10	4·60	4·10
12	Tauranga	6·77	12	3·69	3·58
13	Maraehako Station, Opotiki	16·48	12	11·00	3·48
14	Gisborne	5·92	12	2·65	3·63
15	Taupo ..	2·13	5	0·85	2·82
16	Napier	1·40	7	0·50	2·92
17	Maraekakaho Stn., Hastings	1·30	10	0·41	2·52
18	Taihape ..	1·07	6	0·29	2·52
19	Masterton	1·78	7	0·74	2·70
20	Patea ..	1·08	5	0·38	2·51
21	Wanganui	0·84	3	0·40	2·52
22	Foxton ..	1·15	8	0·64	2·06
23	Wellington (Karori)	1·78	5	1·48	3·07
	South Island				
24	Westport	1.02	3	0·60	5·35
25	Greymouth	3·30	7	1·70	5·99
26	Hokitika	3·28	10	1·79	7·31
27	Ross ..	4·72	6	1·54	8·45
28	Arthur's Pass ..	3·89	5	2·23	10·17
29	Okuru, South Westland	7·47	7	5·72	7·92
30	Collingwood	1·26	7	0·52	5·63
31	Nelson ..	0·62	1	0·62	2·77
32	Spring Creek, Blenheim	0·78	2	0·75	2·25
33	Tophouse	0·54	2	0·38	1·39
34	Hanmer Springs ..	1·65	8	0·52	3·04
35	Highfield, Waiau ..	1·64	5	0·60	2·54
36	Gore Bay	1·22	4	0·79	2·03
37	Christchurch	0·75	6	0·50	1·77
38	Timaru ..	1·72	7	1·36	1·82
39	Lambrook Station, Fairlie ..	0·94	4	0·76	1·89
40	Benmore Station, Clearburn	0·56	4	0·26	1·36
41	Oamaru ..	1·09	7	0·68	1·68
42	Queenstown	1·20	4	0·59	1·98
43	Clyde ..	0·73	2	0·51	0·99
44	Dunedin..	1·66	9	1·40	2·69
45	Wendon	0·86	7	0·50	2·03
46	Gore ..	1.45	8	0·89	2·65
47	Invercargill	1·90	12	0·70	2·85
48	Puysegur Point ..	5·03	18	1·18	4·96
49	Half-moon Bay ..	2·04	9	0·52	4·13

—Edward Kidson, Director of Meteorological Services, Wellington, 6th March, 1930.



MAP OF NEW ZEALAND, SHOWING RAINFALL STATIONS COMPRISED IN *Journal* LIST.

(No. 5A, Rotorua, should be added to North Island list above.)

Minor Crops.—Among other minor crops grown in the 1928–29 season were the following, the figures being total areas for the Dominion: Artichokes (for stock), 210 acres; kumeras, 195 acres; pumpkins and marrows (for stock), 921 acres; osiers, 40 acres; chicory, 54 acres; carrots and parsnips (for stock), 1,013 acres; onions, 880 acres; hops, 608 acres; tobacco, 1,000 acres.

CLASSIFICATION OF CATTLE IN NEW ZEALAND AT 31st JANUARY, 1929.

Land District (including Interior Boroughs).	Bulls Two Years Old and over, for Stud.		Cows and Heifers Two Years Old and over, for Dairying		Other Cows and Heifers Two Years Old and over.	Heifers One and under Two Years Old.	Steers Two Years Old and over.	Steers and Bulls One and under Two Years Old.	Calves under One Year Old.		Total Cattle.
	For Beef Purposes.	For Dairy Purposes.	In Milk.	Dry.					Heifer.	Steer.	
North Auckland ..	1,030	7,882	208,218	16,076	42,132	61,336	37,850	18,356	71,208	23,108	487,196
Auckland	1,591	12,951	377,607	14,695	63,662	98,381	59,389	19,615	115,475	25,198	788,564
Gisborne	3,095	1,248	33,009	3,940	105,014	33,424	38,492	25,033	40,961	32,504	316,720
Hawke's Bay	1,602	1,713	46,916	4,702	50,907	23,533	32,662	12,579	26,741	16,478	217,833
Taranaki	594	7,578	199,439	8,207	25,501	44,387	17,198	6,640	54,895	8,713	373,152
Wellington	3,945	7,128	185,980	12,911	129,084	67,168	91,002	35,220	81,040	42,131	655,609
Nelson	126	1,200	25,606	2,136	6,495	7,534	5,135	2,759	8,319	3,951	63,261
Marlborough	235	672	14,750	1,386	6,719	4,776	4,136	2,499	5,739	2,912	43,854
Westland . ..	166	497	11,591	1,343	6,450	4,709	5,340	2,602	5,290	3,201	41,189
Canterbury .. .	383	2,675	70,746	4,605	15,156	19,213	16,061	7,473	22,131	10,281	168,724
Otago .. .	329	2,106	49,466	4,621	11,504	15,381	13,552	6,816	16,073	8,816	128,664
Southland . ..	340	3,001	67,876	5,237	14,916	19,772	10,958	8,749	20,639	9,536	161,024
Totals, Dominion, 1929	13,436	48,651	1,291,204	79,859	477,540	399,614	331,775	148,341	468,511	186,859	3,445,790
Totals, Dominion, 1928	11,710	47,624	1,242,729	109,669	451,189	362,624	369,553	128,918	405,671	144,082	3,273,769

—*Census and Statistics Office.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 30th January to 27th February, 1930, include the following of agricultural interest :—

No. 62544. Manure-distributor; H T. Lowry, Patumahoe. No 62412: Garden-stake; W A. Hughes, Cromwell No 62601: Marking meat-products; Swift and Co, Chicago, U S A No 64081: Watering-appliance for animals; W. G Beatty, Fergus, Ontario No 61410 Animal-trap; F L Clark, Upper Hutt No 63794. Dried powder from whey, N Z Sugar of Milk and Casein Co, Ltd., Dunedin. No. 64135: Milking-machine; Aktiebolaget Separator, Stockholm, Sweden No 61124: Wool-cleaning; H. G. Howell, Taradale, and T R Howell, Napier. No. 61543: Separator-bowl; Aktiebolaget Separator, Stockholm, Sweden. No 62551. Dosing animals; C M McDonald, Invercargill-Glencoe R D. No 62552. Dosing sheep with tablets; C M. McDonald, Invercargill-Glencoe R D No 63511: Manure-distributor, J M Malcolm, Auckland No 63890 Treating clover-seeds, Warren-Teed Seed Co., Chicago, U S A No 63987: Flax-treatment, W E. Langguth, Auckland No 64022: Ventilation of cream-can, C W Holman and W. Black, Hamilton No. 64098: Manure distributor; J Bamford and C. J Bamford, Uttoxeter, England. No. 64111: Steel post, G D Watson, Sydney, N S W.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s prepaid.

COMMERCIAL GROUND LIMESTONES EXAMINED.

A NUMBER of commercial ground limestones were examined during the year 1928–29 at the Chemical Laboratory of the Department of Agriculture for quality and fineness of grinding The Chief Chemist remarks on these in his annual report as follows —

Y/299, from the Gore district, was a fairly well ground limestone containing 81 per cent carbonate of lime Y/338, from Westport, was a high-grade limestone (94·25 per cent carbonate) of moderate fineness Y/149, from Kakahu, Canterbury, was well ground, and contained 85 per cent carbonate of lime Y/669 was a finely ground stone, containing 89 per cent carbonate of lime, from Dunback, Otago Y/734, from Oamaru, was 97·5 per cent. pure, and was a well-ground sample Y/574-76 were from Southland; Y/574 and 575 contained 60 per cent and 76·5 per cent carbonate of lime respectively; Y/576 was of much greater purity—91·5 per cent—and was very finely ground Y/557, from Limehills, Southland, was ground to a satisfactory fineness, and contained 90 per cent carbonate of lime Y/1073, from Toko, Taranaki, contained 86 per cent. carbonate, and might with advantage have been more finely ground. Y/1076 was a fairly well-ground stone of low grade, from the North Auckland District; it contained 64·1 per cent. carbonate of lime. Y/838, from Silverdale, Auckland, was a well-ground stone, containing 74 per cent carbonate of lime. The prices charged for these commercial ground limestones (where stated) varied from 12s. to 18s per ton, bags extra Several samples of quicklime and slaked lime were also analysed These were all found to be well "burnt" from good-quality limestones.

Noxious Weeds Orders—The Hawke's Bay County Council has declared African boxthorn to be a noxious weed within its jurisdiction. The Heathcote County Council has similarly declared the following plants (at the same time revoking all its previous orders in reference to noxious weeds): Blackberry, ragwort, African boxthorn, Bathurst burr, burdock, Cape honey-flower, dock, fennel, goat's rue, hakea, Japanese wineberry, lantana, ox-eye daisy, pennycress, periwinkle, St John's wort, toad flax, viper's bugloss, winged thistle, Californian thistle, sweetbrier, barberry, broom, Capeweed, cut-leaved psoralea, elderberry, foxglove, gorse, hemlock, kangaroo acacia, lupin, Paterson's curse, prickly pear, pennyroyal, spiderwort, tauhinu, tutsan, wild turnip, woolly nightshade. Thistles: Any species of *Carlina* (stemless thistle), *Carduus* (common plume or Scotch thistle), *Cnicus* (woolly-headed thistle), *Centaurea* (star thistle), *Silybum* (milk thistle).

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

REMEDIES FOR INTERNAL PARASITES IN LAMBS.

G. A. JENKINS, Marohemo :—

In the January issue of the *Journal* appears an article on hogget mortality; and concerning dosing for worms two preparations are mentioned. The 1-per-cent bluestone solution is quite simple and self-explanatory as far as preparation is concerned, but for the turpentine, linseed-oil, and soda drench no details of preparation are given. I should be pleased if you would let me know the quantities of each recommended in the mixture. Also, does it mean washing-soda or bicarbonate?

The Live-stock Division :—

The 1-per-cent. bluestone solution is the agent most commonly used and recommended for the treatment of parasites in lambs. In regard to the use of turpentine the following may be taken as medicinal doses for lambs: A small teaspoonful (one dram) each of turpentine and baking-soda (bicarbonate) are added to 2 fluid ounces of raw linseed-oil, this being a dose for one lamb. The mixture should be well shaken up. The soda is added only with a view to forming an emulsion. If desirable the same quantity of turpentine may be given in milk, the soda being omitted. Thorough shaking is advised to mix the turpentine. Care also is necessary when dosing with a turpentine solution, as the animals are liable to cough. Large quantities are made up in proportion: thus 10 oz. each of turpentine and baking-soda added to a gallon of raw linseed-oil will provide for eighty lambs, allowing each lamb 2 fluid ounces of the mixture.

ESTABLISHING PASPALUM ON UNPLOUGHABLE COUNTRY.

"K4," Russell :—

Kindly advise me the best and quickest method of laying a permanent pasture of paspalum on unploughable clay hills, such as found near the coast in the North Auckland territory. Please state best time to sow, preparation of seed, and other information that would be useful.

The Fields Division :—

Under the conditions mentioned paspalum is likely to be slow in establishing. Surface sowing with from 6 lb. to 8 lb. of seed per acre in November or early December is the best method. With the establishment of scattered plants over the area the sward will be rapidly thickened by allowing as much reseeding as possible in the early stages. The seed should give a good percentage of germination, and the surface should be clear of rough grass or other growth. Firing or heavy stocking should precede the sowing if necessary. Finally, it must be remembered that in order to thrive paspalum requires fairly good surface fertility, and it is possible that danthonia and brown-top would do better on the country you refer to.

STARTING A VINEYARD IN HANGATIKI DISTRICT.

W. G. J., Hangatiki :—

Please inform me regarding the best way to start growing outdoor grape-vines in this district for table purposes, and best sorts to grow. The plot would be on rolling country lying to the sun, with loam soil and natural drainage.

The Horticulture Division :—

To establish strong vines which will crop at least a year earlier than vines planted in superficially cultivated soil (and this applies more especially to soils

of a compact nature) it is essential to cultivate the land deeply and to subsoil it. If it is in pasture the turf should be broken up previously to being turned in ; or if it is in fallow a crop of lupins can be grown for the purpose, or a top dressing of "tailings" from blood-and-bone manure applied This consists of bits of wool, bone, horn, &c., and helps to feed the vines for several seasons. If the plot is to be prepared with the spade—which is the better way—the soil should be worked so that the top soil, turf, &c, forms a layer 6 in. to 12 in below the surface, and another 6 in. or more below it should be subsoiled If a plough is used this method should be approached as near as possible, so that the roots of the vines, which prosper particularly well in newly-turned-in top soil, can spread freely through the ground. After the vines are planted superficial cultivation, so as to avoid injuring the rootlets which feed near the surface in spring, is all that is required to keep the soil free of weeds and in a condition of fine tilth The routine cultivation consists of ploughing out lightly from the vines in autumn, and disking inward in spring and summer.

The most popular market varieties are Albany Surprise and Black Hamburg (both black grapes). The first-named sells especially well on the Auckland and Hamilton markets ; but it would not be prudent to plant many of either variety until you are satisfied that your local conditions suit them. With a view to ascertaining which are the most suitable varieties to grow, especially from a ripening point of view, we would recommend, in addition to Albany Surprise and Black Hamburg, which ripen in March, growing a few of each of the following Madeleine Royale, Goldriesling, Agostenga, Chasselas Doré Salomon, Portugais Bleu, Iona, Muscat Hambro, and Temprano. These ripen approximately in the order given, and from among them a continuous supply over a period of about three months should be obtained These varieties can be obtained in August (though it is advisable to order earlier) from our Te Kauwhata experimental vineyard at listed prices.

MARE IN POOR CONDITION.

S. P. A., Pleasant Point :—

I have a draught mare about ten years old, and this season she is in unusually poor condition and is pot-bellied, though eating well I think she has bots, and should be glad of a prescription and method of treatment to get rid of them She is not doing any work, or practically none

The Live-stock Division :—

It is not usual for horses harbouring bots alone to develop "pot-bellies" The poor condition of your mare, together with her abdominal enlargement, are more likely to be due to the presence of intestinal parasites and derangement of the digestive organs. A good treatment would be—Turpentine, 2 oz, raw linseed-oil, 1 pint, given as one dose and repeated in ten days. During that interval give one powder daily containing ferri carbonate, 2 drams; soda bicarbonate, 2 drams, in food. The animal's teeth should be carefully examined to make sure that mastication is good.

Wheat Research.—At the February meeting of the Research Council the Chairman made the following reference to this work. "The scope of the wheat investigations has now been fully extended. A large number of additional crosses has been made at Lincoln College during the past season, and these, together with the product of others made in previous seasons, are now being harvested. The appointment of a baker to the Institute will enable baking tests to be made of flour from wheats previously analysed, thus giving the fullest information on all of the factors influencing wheat and flour quality Arrangements have been made whereby the services of the Institute will be available to millers for the purpose of effecting improvements in and standardizing the quality of their flour output. A valuable preliminary research on the possibility of using header harvesters in the climatic conditions prevalent in New Zealand wheat-growing districts has been carried out. The actual field trials conducted with these machines this season will be surveyed by the Institute with a view to estimating the result on wheat and flour quality of such a method of harvesting."

BONUS OFFERED FOR MAJOR IMPROVEMENTS IN MANUFACTURE OF PHORMIUM FIBRE.

THE following notice was published in the *New Zealand Gazette* of 13th February, 1930, over the name of the Hon. G. W. Forbes, Minister of Agriculture:—

Subject to the conditions hereinafter appearing, the New Zealand Government hereby offers to pay £10 000 as a bonus or bonuses for major improvements in connection with the extraction and dressing of fibre from the New Zealand hemp-plant (*Phormium tenax*)

(1) The machine or process in regard to which the whole or any part of the bonus is to be paid shall be recommended by a committee set up by the Government, and shall be approved by the Government

(2) The £10,000 will be paid wholly or in part for a commercially practicable process of extracting and dressing the fibre of New Zealand hemp (*Phormium tenax*), whether by machinery or otherwise, whereby there shall be obtainable—(*a*) A greatly improved quality of fibre marketable at a higher price, (*b*) a considerably greater quantity of strong white fibre per ton of green leaf, (*c*) a substantial reduction in the cost of producing the fibre: Provided that in determining the amount of the bonus to be paid for any such process due regard shall be had to the rate of any royalty required to be paid by millers for the use of such process, and no bonus whatever will be paid—(i) Unless it can be satisfactorily demonstrated that the improved process submitted in comparison with the best of present methods will enable the net returns from an efficient flax-mill to be increased by at least 15 per cent, or (ii) if the amount of any such royalty will absorb the whole or substantially the whole of the increased net return above referred to

(3) Any applicant for the bonus or part of the bonus must have fulfilled the following conditions at the time of application: (*a*) The machine or process in question must have extracted the fibre from not less than 500 tons of green leaf; (*b*) The fibre extracted from the 500 tons of green leaf must have been graded by a Government Grader, and not less than 90 per cent of such fibre must have reached a grade not lower than "good fair."

(4) Applications for the bonus must be addressed to the Director-General, Department of Agriculture, Wellington, and must reach him not later than noon of the 30th November, 1931 They must be enclosed in an envelope clearly marked "Application for *Phormium* bonus"

(5) Each applicant shall state what royalty, if any, would require to be paid by millers for the use of his process during the currency of his patent rights.

(6) As soon as possible after the expiry of the time for receiving applications for the bonus (30th November, 1931), the Government will appoint a committee of not less than five—of whom two shall be New Zealand hemp-millers—to open and examine the applications, to investigate such of the competing machines or processes as it considers worthy of trial, and to make recommendations to the Government as to the payment of the bonus, having regard to the amount of royalty, if any, specified in such applications

(7) Each applicant must give, at his own expense, such reasonable demonstrations of the working of his machine or process as shall be demanded by the said committee, and such demonstrations shall take place in New Zealand.

FORTHCOMING AGRICULTURAL SHOWS.

THE following show-dates during the remainder of the 1929–30 season have been notified by agricultural and pastoral associations.—

Methven A and P Association: Methven, 29th March.
Cheviot A. and P. Association: Cheviot, 3rd April.
Oxford A. and P. Association: Oxford, 3rd April
Flaxbourne A. and P. Association: Ward, 10th April.

The New Zealand
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THE EVOLUTION OF GRASSLAND FARMING IN NEW ZEALAND.

Paper presented by A. H. COCKAYNE, Assistant Director-General, Department of Agriculture, to the Empire Farmers' Conference, held at Wellington, 24th March, 1930.

DURING the tour of the Empire Farmers' Delegation in both Islands of New Zealand the development of our farming systems must of necessity have been largely viewed with reference to British conditions and British traditions based on centuries of experience. In this paper I wish to bring forward some of the main New Zealand view-points built on an extremely short agricultural history, but one which has undergone far more rapid evolutionary changes than would ordinarily be considered possible by any one from a country where agriculture has become stabilized.

Less than a century ago New Zealand consisted mainly of four great types of country:—

(1) Forest of varied and often very dense nature, belonging to types essentially different from those originally clothing great parts of Britain.

(2) Scrub and heath lands, partly of a stable nature, but mainly representing one of the successional stages back to forest.

(3) Large areas of swamp land, the cover varying from fen vegetation to forest.

(4) Open grassland, known as tussock grasslands, which had developed entirely in the absence of any grazing-animals, and which were essentially climatic in origin.

Roughly expressed, the wetter areas of New Zealand were covered in forest and the drier areas were in natural grassland. Known methods of cultivation and stocking were of no value in bringing into agricultural profit the vast areas of forest-clad country, so it was on the open unforested country that development first took place, and, as these areas occurred mainly in the South Island, that portion of New Zealand showed in the earlier years the greatest advancement. The original farming community, recruited as it was with excellent British farming experience, rapidly adopted rotational practice on the more fertile, easily ploughable tussock grasslands, and depastured ever-increasing flocks of merino sheep on the natural tussock areas

where topographical considerations precluded easy ploughing. To commence with, cereals and wool represented the only saleable commodities that did not reach immediate saturation-point, and had it not been for two factors the agricultural development of New Zealand might have remained comparatively insignificant. These two factors were the comparatively early discovery that a good seed-bed for the establishment of pastures of European grasses could be produced by felling and burning the forest, and the later development of cold-storage processes enabling meat, dairy-produce, and other perishable products to be exported.

The conversion of forest into grassland without the intervention of the plough represents the first major development in the evolution of New Zealand farming, and has resulted in over 12 million acres of grassland replacing forest The firestick therefore became the real emblem of farming progress in New Zealand for many years rather than the plough, although it was considered that the majority of ploughable "bush-burn" country would finally come under some sort of rotational treatment whereby the production of fresh young grass would be connected up with the production of annual crops, either of a cash-sale or animal-feeding type For many years from 200,000 to 400,000 acres of forested country were annually burned and grass-seed sown on the scarcely cooled ash. The forest did not in all cases surrender to the artificially produced grass invader without a valiant struggle, and a whole range of stocking and secondary-burning technique became developed to cope with the efforts of forest to again reassert itself.

Until the development of the freezing industry the artificially produced bush-burn grasslands and the natural grasslands were essentially used for wool-production. Meat in the quantities in which it could be produced was unsaleable; the value of a carcass was measured in terms of the tallow that it could yield, and thus arose the boiling-down establishments of both Islands. Over the greater part of the bush-burn grassland long-wools—firstly Lincoln and later Romney—became the dominant breed. The rise of the Romney coincided to a certain extent with the gradual fall in nutritive value of the bush-burn pastures as they passed through successional changes tending to a lower standard.

The capacity to export meat and dairy products, commencing with the first trial shipments in 1882, gave New Zealand the opportunity to develop itself into the dairy and fat-lamb farm of the Empire, and, going back a stage further, it can be said that it is due to Faraday's classical researches in pressure on gases that New Zealand owes the greater part of her farming progress. From the "eighties" New Zealand's farming future became definitely a grassland one; but full recognition of that fact did not become general for many years after and is hardly yet sufficiently appreciated. The development and improvement of grassland was hardly viewed as farming at all, due to the inherited thought among the farming community that the plough was the only true symbol of agriculture, and that grazing without extensive cropping merely represented a stop-gap for the time being.

Two factors of great importance developed comparatively early in the history of grassland for wool-production. These were the presence

of sheep-scab and the development of the rabbit pest. Due to the untiring efforts of the Government, sheep-scab was in a comparatively short space of time wiped out by a rigid system of inspection, treatment, and final elimination of all scabby animals The rabbit pest for many years was a serious menace to production on lower-value grassland, and did not finally become of minor importance until the introduction of strychnine poisoning, coupled with the steadily increasing value for the skins, making control a much less complicated matter.

So far as the mountainous natural tussock grasslands are concerned, their history has been one of gradually diminishing fertility, and as their area is large—over 14 million acres—and their production and value low, they can be viewed with our present knowledge as probably a potentially decreasing asset in connection with farming, unless better feeding types of vegetation can be established on them at a nominal cost. Investigation in this direction, however, has not been by any means encouraging. On the other hand, it is far otherwise with the sown grasslands of the country, which, with their companion annual stock-feeding crops (themselves now steadily decreasing in proportion), comprise some 18 million acres. This area of sown grassland at the present time is only slowly extending in comparison with the bush-burn days, as most of the virgin country still to be won to payable grass is mainly almost of a submarginal character, particularly during eras of falling prices.

The main production from this 18 million acres consists of meat, wool, and butterfat, and by-products such as hides, pelts, &c, connected therewith. The sown grasslands of the Dominion are responsible for an annual output of roundly 250,000 tons of meat (mutton and lamb 200,000 tons, beef 30,000 tons, pork 20,000 tons), 70,000 tons of wool, and 140,000 tons of butterfat. Brought to a per-acre basis this means about 30 lb. of meat, 9 lb. of wool, and 17 lb. of butterfat

With normal prices the present annual value of grassland products exceeds £50,000,000, a figure that could quite easily be doubled by better appreciation and application of scientific grassland-management. The value of such management and all that it stands for is fast becoming recognized not only by the farming community, but also by all commercial, political, and scientific interests.

Grassland products in the shape of these saleable commodities, primarily elaborated by the cow and the breeding-ewe, represent in New Zealand farming the dominant features of production. Not only do they far outstrip in value the combined production of all other agricultural endeavour, but their potential development, provided adequate marketing avenues are opened up, is so great that it can be safely said that New Zealand's farming future definitely lies mainly along the line of their expansion. This recognition that grassland farming, as distinct from rotational farming or extensive grazing, in a country with the climatic advantages of New Zealand can be as highly technical and complicated an art as any farming where the plough plays a dominant part may be viewed as the outstanding feature in our agricultural thought of the present day. For many years the European conception of grass as a limited seasonal crop necessitating, so far as milk and fat-stock production are concerned,

ample provision of specially grown crops was universally held in New Zealand, and yet growing up within the country itself, particularly in the districts of better rainfall, there gradually became established the idea that manipulation of both grass and stock could be so directed as to, in many cases, avoid any extensive growing of special crops.

Probably the most important direction taken in grassland-management, to minimize the weakness of grassland so far as seasonal production is concerned, was the trend to make ever-increasing use of female animals, in the shape of the dairy cow with a definitely dry period during winter and the breeding-ewe with a definitely high feed-requirement in the spring and summer. During recent years the proportion of dairy cows to total cattle wintered and of breeding-ewes to total sheep wintered has steadily increased, and can be viewed as the definite trend of development. From this, two outstanding theories in regard to grassland-management were evolved. Firstly, that the feed requirement of the grassland farmer should be at its lowest point in the winter, and, secondly, that summer-grass production should be converted into milk—in the case of the dairy-farmer represented by butterfat sold as such, and in the case of the sheep-farmer by the fat lamb.

This second theory—that as large a proportion as possible of the summer growth of grass should be converted into milk—made it essential that such herbage should be of a milk-producing type. In other words, that it must be young, vigorous-growing, highly mineralized, and high in available protein. In this connection it is interesting to note that high-class grass in New Zealand may contain up to and over 30 per cent. of protein, making it remarkably suitable for milk-production.

At the present time New Zealand grassland-farming practices are largely centred on the development of the three following phases :—

(1) The production of better conditions for pasture growth.

(2) The provision for better management and better facilities for better utilization

(3) The provision of stock better suited to influence directly the economic efficiency of better conditions and better utilization.

All these three phases of grassland-management are being developed, intensified, and standardized—in certain instances with a rapidity that savours of the magical, but in others quite slowly, indicating clearly the complexity of the whole general problem and that of the "unknown" emerging with every forward step taken. The main features that rapidly pass through one's mind in considering these three phases of grassland-farming practice are clear enough, even though the list be long. They comprise drainage, fertilizing, liming, surface cultivation, hay and ensilage making, mowing of surplus growth, smaller paddock subdivision, more adequate watering, shelter, disease-control, and breeding under tested control.

The greatest single factor at the present time that is commencing to greatly stimulate production from grassland is top-dressing. The area top-dressed is being increased at the rate of many hundreds of thousands of acres annually, and well over 300,000 tons of fertilizers, almost all of a phosphatic nature, are being used on grassland in lengthening both the growth-period and increasing the actual pro-

duction of high-protein grass. In addition, about one-quarter of that quantity of lime is being used, mainly in the shape of ground limestone. Even though top-dressing has increased greatly of recent years, the total area annually dealt with is still well under 3 million acres. I forecast that within the next decade—provided expanding and payable markets are maintained—our top-dressing tonnage will reach the million mark. The fact that most New Zealand soils are naturally low in phosphates makes phosphatic fertilizers of first consideration, but the change from single to more complete manuring, where lime, nitrogen, and potash steadily gain in importance, is not far distant. So far as lime and nitrogen are concerned, future requirements need give us no concern, but the safeguarding of adequate phosphate and potash supplies is of the very first importance

Another development that is just making itself felt in the more highly developed grassland districts is the conservation of surplus summer herbage as ensilage. The making of grass ensilage has proved itself not only of immense value in pasture-management, but provides a summer supplementary feed that is unsurpassed in reliability by any crop that can be summer-produced, with perhaps the exception of lucerne, a crop unfortunately that has a comparatively narrow range in New Zealand.

Of perhaps more real significance than any other feature of grassland farming, and at present barely recognized, is the question of strain so far as the actual grass crop is concerned. Along this line work somewhat similar to that being conducted at the Welsh Plant Breeding Station is being carried out by the New Zealand Plant Research Station. It has clearly shown that the running-out of pastures is due very largely to the types sown being of a bad or non-permanent character, and that when leafy persistent types are used all those methods of modern management leading to higher production are rendered far more economical and efficient. So far as perennial rye-grass is concerned the work is well advanced, and other grasses and clovers are being brought under study. The pedigree grass, capable of maximum returns under the hard stocking conditions contemplated by what has been termed rotational grazing, is really as essential as pedigree stock if anything like full utilization of grass-growth is to be realized. Recognition of this fact and the application of that recognition is destined to play an even more important role in New Zealand grassland-management than any of the milestones which have been passed in the history of New Zealand farming.

Failure to establish high-class permanent pasture, even on first-class land after the land has been ploughed, has been all too common in New Zealand, and has led to the idea that it is generally better to improve existing grassland by liberal management rather than by renewal. The idea has in many cases been perfectly sound where the seed mixtures used, although permanent in name, are temporary in effect. So soon, however, as reliability can be given to the strain and real leafy permanence of the seed for laying down permanent pasture, very large areas of the present established grassland of inferior botanical composition will be renewed, with astonishing results so far as production economy in management is concerned.

Improvement in grass and clover strain, improvement in growth-conditions, improvement in utilization, and improvement in stock

attuned to grassland-management conditions — all of which are being rapidly developed and applied — make it clear that grassland products will enormously increase in the near future, and the estimate of a doubling of our production in a comparatively short space of time is likely to become a reality. It may bring in its train several grave difficulties, particularly those of marketing Another weakness is that grassland farming offers only a limited variety of output, and in seasons when prices for both cow and ewe products are depressed the farmer's financial position may become embarrassed. Nevertheless, the future destiny of New Zealand, to my mind, is grassland farming developed to its very highest stage. Many other features of land-utilization will no doubt develop and extend, but they are unlikely to ever overshadow in any way New Zealand's capabilities for growing milk-producing grass.

Of the 18 million acres of sown grassland and auxiliary forage crops under grassland farming, probably about 5 millions are used for dairying, and 13 millions for sheep with their accompanying beef animals. A very large area of this dairying-land is, comparatively speaking, in a more or less unimproved state compared with fully developed pasture. If one takes 4 million acres as the area dairied on, the average yield is about 70 lb of butterfat per acre. When it is considered that under present conditions yields of over 250 lb. per acre have been realized, the potentiality for increase in dairy-products is quite evident. In fat-lamb production, again, highly top-dressed farms are now carrying six and seven ewes to the acre, which before top-dressing did not do better than two; and when one considers that top-dressing and special sheep-grassland management is only in its initial stages, the outlook for the ewe is as favourable as that for the cow.

Lamb in ever-increasing quantities, mutton in comparatively slowly increasing amounts, increased quantities of wool (particularly of qualities ranging from 40's to 50's), and an enormously increased amount of butterfat indicate our main grassland products export bill of fare.

A feature in our dairying that must have struck members of the delegation is the comparatively small use made of pigs. There is about one breeding-sow in New Zealand to every twenty cows, and the total annual amount of meat derived from the progeny of each sow is about 700 lb., or somewhere about 40 lb. per cow. This extremely poor result is in many quarters attributed to the fact that owing to the high cost concentrate feeding is not payable. There seems little doubt, however, that increase in pork-production could be largely brought about by reasonable management connected up with our grass-farming system. Unfortunately at the present the argument is that we should adopt feeding and management systems in vogue in other countries, instead of working out a system that is applicable to our own conditions. In our agricultural history it has been the adaptation rather than the adoption of method that has made for progress, and the same undoubtedly will be true in the pig industry. I am convinced, however, that sooner or later pork in large quantities will rank as our second, if not main, meat export,

but before that comes about the development of a system in tune with our grassland management must be evolved.

This paper has dealt entirely with the evolution of grassland farming here. There are, of course, other avenues of production which, although small in comparison, are important enough. Some are certainly capable of extension, others will fade away, and others, again, may be maintained for fiscal or other reasons.

Over parts of the drier area of the South Island sown pastures tend to rapidly revert to a dry-stock-carrying basis and have to be renewed, necessitating the farm team or tractor as an integral basis of management. Rotation farming has therefore to be adopted, and in consequence both autumn- and winter-sown crops are necessary for economical distribution of cultivation costs. Cereals, particularly wheat, are especially useful in this direction, and wheat-growing has to be carried out We grow an average of about 200,000 acres of this cereal, with a yield of over 30 bushels, and, provided protection is afforded, wheat-growing is likely to expand in relation to population increase. Oats, on the contrary, are a diminishing crop, the internal-combustion engine having rapidly restricted the supplies necessary. As to barley, some 20,000 acres provide sufficient for our requirements. Cereals, other than oats, for the production of stock-feeds play little part, as their cost, and particularly their transport costs, preclude their extensive use. The outlook for the arable rotational farm is not particularly good, but it is possible that certain special crops may become developed which will help to pay for the farm team. In this connection the growing of grass and clover seeds of pasture-strain types would appear to offer great promise, both for local use and for export. Real "mixed farming" in suitable districts may, indeed, have a strength all its own.

STATISTICS OF FARM MACHINERY AND ENGINES.

FOLLOWING is a summary of farm machinery and engines employed on rural holdings (outside borough boundaries) in New Zealand for the past five years:—

Class of Machinery, &c.	1925.	1926.	1927.	1928.	1929
Milking-plants	15,561	16,391	17,090	18,049	18,756
Cream separators	44,656	45,765	45,246	45,246	45,781
Shearing-machines—					
Plants	5,728	5,949	6,305	6,518	6,887
Stands	18,445	18,797	19,269	19,677	20,329
Wool-presses	8,601	8,641	8,832	9,504	9,235
Agricultural tractors	1,026	2,025	2,588	2,883	3,377
Reapers-and-binders	15,881	15,574	15,287	15,432	15,172
Threshing-machines	377	361	364	406	406
Chaffcutters	2,903	2,865	2,562	2,326	2,297
Water-wheels or motors ..	846	817	784	932	824
Electric motors	3,451	6,356	8,436	10,806	13,377
Steam-engines	622	473	435	505	397
Internal-combustion engines ..	19,894	19,584	18,885	18,321	18,489

—*Census and Statistics Office.*

IODINE DEFICIENCY AND LIVE-STOCK.

A PRELIMINARY INVESTIGATION IN THE WANAKA AREA.

1. Goitre in Lambs.

C. S. M. HOPKIRK, Officer in Charge, Wallaceville Veterinary Laboratory, and C. V. DAYUS, District Superintendent, Live-stock Division, Dunedin

MANY parts of New Zealand are known to be short of iodine in the soil and water, but this is particularly the case in the Cold Lakes region of the South Island. Nevertheless it is not common to find more than an odd case of goitre in farm animals in the deficient districts. In October of last year, however, one station-owner in the Wanaka area reported the birth of a large number of lambs with enlarged thyroid glands. The history of the occurrence may be given as follows.

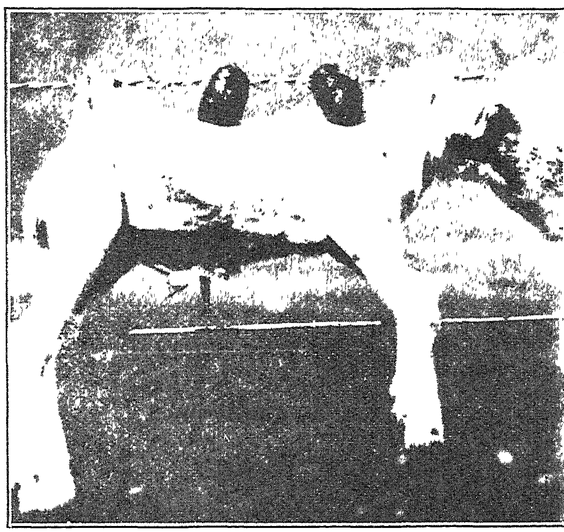
A flock of 1,400 crossbred ewes was run on 600 acres of flat at the base of a high range of hills. The flats are rich and grow good feed, mainly English grasses and clovers, though cocksfoot tends to become dominant over the rye-grass. Winter fodder, consisting of turnips and clover hay, is also grown on these flats, so that animals do not get food which has been grown in another district, and therefore any deficiency present in the soil is reflected in the pasture and eventually in the sheep. Some 300 of the 1,400 ewes had been brought down from the hills and placed with the flock one year previously, as representing the strongest-woolled of the hill sheep. The other 1,100 had been on the flats for two years, and it was lambs from the 1,100 which were affected. About 200 merinos were also wintered on the flats for the one season only.

The pastures had been down for a number of years, but some were five and six years old only. The flats were divided into paddocks of 30 to 50 acres. Previously to 1926 no top-dressing had been done. Since then some of the paddocks on the farm had been top-dressed once or twice, while others had received no treatment. Sulphate of ammonia had been applied only to a few acres, and not in the paddocks referred to. The health of the sheep was good, and they were in good condition. Ante-partum paralysis was held in check by judicious feeding and exercising, and pulpy kidney occurred in only six lambs during the early season of 1929, but more died at twelve to fourteen weeks from that trouble. The affected sheep had been fed for the last two years on a lick composed of salt, 112 lb.; Kerol, 2 pints; iron sulphate, 2 lb.; sulphur, 4 lb.; rock phosphate, 4 lb.; calcium carbonate (97 per cent.), 20 lb. An amount of 30 cwt. had been fed over the year.

The ewes commenced lambing in October, and over a hundred were born with enlarged thyroids, the enlarged lobes being from a hazel-nut to a duck's egg in size. Some of the larger glands were cystic. Analysis of these thyroids carried out by the Chemical Laboratory of the Agriculture Department showed from 0·0009 per cent. of iodine by weight of gland to 0·0296 per cent. in the case of a gland which was almost normal in size. Dr. Orr, of the Rowett Institute, gives the normal fœtal gland as 0·03 per cent. The majority analysed were in the vicinity of 0·001 per cent. Besides enlargement of glands the lambs

showed other definite symptoms of iodine deficiency, such as hairlessness, smallness of fœtus, a tendency to œdema, and in some cases coarse hair instead of the usual lamb's wool. If the lambs were born alive and remained alive for three days there was some hope of their living, but many born alive died from weakness without getting on their feet.

Further post-mortem examination showed œdema of the meninges of the brain, some congestion of mid-brain, but no definite hæmorrhage



ONE OF THE DEAD LAMBS IN WANAKA AREA.
The enlarged thyroid glands have been taken out and are seen above carcass.

was seen. The heart was petechiated, and there were hæmorrhages on endocardium. The pericardial sac was filled with fluid; bladder usually full; kidneys œdamatous, pale, not firm when capsule stripped; some small areas of congestion showed as mottling through the capsule of the kidneys.

One lamb which was found alive and taken to the house for treatment was given three drops of tincture of iodine in milk three times per day, and in a week was practically normal, the goitre having almost disappeared. In lambs which lived three days, however, the thyroids tended to decrease in size without treatment.

2. Various Aspects of Iodine Deficiency and the Wanaka Investigation.

B. W. SIMPSON, Rowett Research Institute, Scotland. (On loan to Chemistry Section, New Zealand Department of Agriculture.)

Since iodine is a necessary element in biological processes, its presence in soils, pastures, and animal tissues is of fundamental significance. An investigation into the cause of a high mortality among lambs in the Wanaka area resulted in some interesting data; a description of the occurrence has been given in the preceding section.

At Makarora, up the valley from the head of the lake, the stock was poorly developed—especially yearling calves, which were small of size—sterility was prevalent, and cream-production very low, although the pastures seemed luxuriant and rich. Rams brought into this district grew coarse-haired, and the wool only recovered its fineness when the animals were removed to other pastures. Hairlessness in lambs was also noted. An iodine deficiency was obviously the primary cause of the weak stock in a case near the lake itself. Samples of soils, pastures, milk, and thyroid glands were taken for analysis.

Soils.—The iodine content of soils varies considerably, being in New Zealand anything up to 900 parts in 10 million. Three soil-samples taken from Wanaka gave an iodine content of 6, 15, and 7 parts in 10 million. A soil from Islington, near Christchurch, for comparison, gave 28 parts in 10 million. Two samples from Makarora gave 2 and 15 parts in 10 million. These five soil-samples from Wanaka have extremely low iodine contents.

Pastures.—There is little or no correlation between the iodine content of a soil and the iodine content of the pasture grown on it. Some soils, although rich in iodine, give up none to plants. Generally speaking, these are alkaline soils. Acid soils, on the other hand, give up their iodine very readily to plants.

As there exists a very critical iodine dosage for plants, as well as for animals, above which toxic processes set in and below which full development does not take place, it can be understood why field trials with iodine manuring are often very contradictory. The empirical application of iodine to soils in manures and otherwise is therefore generally useless. If the nature of the soil is not taken into consideration the result may well be, as far as the crop is concerned, nil, or a diminution instead of an increase may even result if the optimum dosage is exceeded. Hilly pastures in New Zealand are generally richer in iodine than valley pastures. This is of interest, because at Wanaka the lambs of hill sheep are healthy; only those of paddock sheep are affected. The soils at Wanaka which had an iodine content of 6, 15, 7, 2, and 15 parts iodine in 10 million grew pastures with 13, 32, 11, 14, and 13 gammas * iodine per 100 grammes of dried material respectively. An Islington pasture, grown on a soil with 28 parts iodine in 10 million and sampled at the same time of the year as the Wanaka pastures, had 95 gammas iodine per 100 grammes dry material. The Wanaka pastures are low in iodine, and this in spite of the fact that the Wanaka stock was getting iodine licks from boxes in the paddocks, so that the natural iodine content was probably much lower.

Milk.—Iodine is always found in milk. In New Zealand milk-samples the iodine content varies within narrow limits. Milk-samples from the Whangarei area have generally about 6 gammas iodine in 100 c.c., and samples from the Christchurch area about 4 gammas per 100 c.c. One sample from Wanaka contained 2 gammas, and another had only about 1 gamma per 100 c.c.

Thyroid Glands.—The thyroid gland contains a higher percentage of iodine than any other tissue in the animal-body. A deficiency of iodine in the food of an animal reacts on the thyroid gland in such a

* A gamma (γ) equals one-millionth part of a gramme.

way that an inverse relationship exists between the size of the gland and the iodine content. Glands from the Wanaka area are very large and contain very little iodine. No. 2 of Table 1 may be taken as normal for comparison. Dr. Orr found the thyroids of fœtal lambs to have about 0·03 per cent. iodine fresh weight. A Wallaceville lamb had a thyroid weighing 0·9 gramme with an iodine content of about 0·06 per cent. fresh weight; this animal was about six weeks old. The Wanaka lamb thyroid weights and iodine contents were as follows:—

Table 1.—Analyses of Lamb Thyroid Glands, Wanaka Area.

No.	Weight of Gland.	Percentage Iodine.	Iodine Content.
	Grammes.		Grammes.
1	27·0	0 0009	0·0002
2 . ..	3·2	0 0296	0·0009
3 . ..	10·8	0·0012	0 0001
4	60 9	0 0005	0 0003
5	32·3	..	..
6	202·7	0 0007	0·0014
7	21·1	0 0106	0·0022
8	46·3	0·0525	0·0243

The first five samples are glands of lambs dead at birth or about three days old. The last three glands were obtained from animals which had been fed on iodized lick for four weeks previous. At Makarora a sheep's thyroid weighing 4·6 grammes gave an iodine percentage of 0·02. A Whangarei sheep's thyroid weighing 7 grammes had an iodine percentage of 0·2, and an Islington sheep's thyroid weighing 6 grammes had 0·1 per cent. iodine. These are given for comparison. At Makarora a foal which died eighteen hours after birth had a thyroid weighing 37·4 grammes with an iodine percentage of 0·003. The iodine content of soils, pastures, milk, and thyroid glands from this Lake country area is therefore low when compared with the iodine content of similar samples from other areas in New Zealand.

A study of the general analysis of milk and pasture samples from Wanaka (Tables 2 and 3) in order to ascertain if there is any further mineral deficiency has been rather complicated by the addition of salt licks to the foodstuffs. Cows' milk from Wanaka, when compared with cows' milk from Whangarei, samples being taken at the same time of the year and at the same stage of lactation, gave practically the same mineral content. Unfortunately no record of the yields was

Table 2.—Analyses of Cows' Milk.

(Results, except for iodine, are expressed as percentages on the whole milk.)

Locality.	Date.	Iodine (I_2).	Chlorine (Cl_2)	Phosphoric Acid (P_2O_5)	Calcium Oxide (CaO).	Potassium Oxide (K_2O)	Nitrogen (N_2)	Magnesium Oxide (MgO).
Whangarei ..	28/11/29	6γ	0·10	0·24	0·18	0·16	0·59	0·02
Wanaka ..	21/11/29	2γ	0·11	0·23	0·17	0·16	0·57	0·02

Table 3.—Analyses of November Pastures, Wanaka Area.

(Results, except for iodine, are expressed as percentages of the dry matter.)

Lab. No.	Locality.	Material.	Iodine in Gammas per 100 grammes Dry Material.	Phosphoric Acid (P_2O_5).	Calcium Oxide (CaO).	Magnesium Oxide (MgO).	Sodium Oxide (Na_2O).	Potassium Oxide (K_2O).	Nitrogen (N_2).	Iron (Fe).	Manganese (Mn).	Ash.	Crude Silica (SiO_2).	Alumina (Al_2O_3).	Sulphur (S).	Chlorine (Cl_2).
Z/ 1332	West of Lake Wanaka	Hay	13	0·65	2·54	0·83	0·07	3·89	4·8	0·029	0·007	11·6	0·61	0·05		0·35
1331	Ditto	Red clover	10	0·52	1·55	0·45	0·08	2·43	1·6	0·012	0·009	7·4	0·55	Trace	.	0·49
1333	,,	Pasture	32	0·50	1·99	0·56	Trace	4·61	4·9	0·019	0·014	11·4	1·13	,,	0·37	0·40
1334	,,	,,	32	0·79	1·25	0·45	0·14	3·50	3·4	0·014	0·019	9·3	1·51	,,		0·32
1335	,,	,,	11	0·85	[illegible]	0·54	0·15	4·15	[illegible]	0·022	0·011	10·7	2·67	0·02		0·65
1357	Makarora	,,	14	0·45	[illegible]	0·51	Trace	3·6	5·2	0·018	0·010	8·9	0·70	Trace	0·40	0·25
1358	,,	,,	13	0·82	1·01	0·41		3·86	4·5	0·013	0·027	8·9	1·03	,,		0·14
1359	,,	,,	17	0·98	2·28	0·35	0·07	2·62	5·5	0·019	0·018	9·0	0·99	,,	.	0·21

kept. The general analysis of November pastures from Wanaka is also of interest. The iodine content is low, in spite of the fact that iodized salt licks were fed from boxes on some of the paddocks. Chlorine and sodium contents are low and calcium is high.

The dosage of iodine now in use at the Wanaka stations referred to is 2 oz. potassium iodide in 112 lb. of salt, fed from boxes to which the ewes have easy access. Whether this is sufficient to prevent the recurrence of the high mortality among lambs will be seen next season. The optimum dose for a sheep is 3 to 4 grains per week. This small dose ensures the full effectiveness of a mineral ration by increasing the assimilation of calcic oxide, phosphoric acid, and nitrogen in the food. Ten grains a week is sufficient for a bullock or cow, and 6 grains for a horse or a pig. Poultry show a remarkable reaction to iodine feeding; $\frac{1}{10}$ grain of potassium iodide fed to a hen per week increases the iodine content of the egg 600 times. The eggs from hens on experiment in Wellington, to which potassium iodide was fed, were 100 per cent. fertile, and 85 per cent. of the chicks were pullets. If too large a dose of iodine is fed to hens the moult is very complete.

It has been suggested that the thyroid enlargements found at Wanaka may have a causal relationship to the feeding of a lick containing salt, Kerol, lime (obtained from a friable deposit found in the vicinity), and ground raw rock phosphate. Whether all or any of these ingredients aggravated the critical condition of the lambs it would be difficult to say. Thyroid enlargement is in many cases associated with limestone country, but no definite correlation between excess of calcium in the soil and incidence of goitre has been found. An experiment is to be carried out on rabbits, which may throw some light on this vexed question. A low iodine basal ration, consisting of hay, grain, and roots from Wanaka, is to be fed to the control group. A second group will get this basal ration plus lime, a third basal ration plus salt, and a fourth basal ration plus phosphates. If possible, other groups may be added. A comparison of the weights and iodine content of the

thyroid glands should be of interest In view of the fact that all over Central Otago generally many lambs have small thyroid glands of low iodine content, it may be that at Wanaka some external factor in the shape of excess or deficiency of another mineral made a critical iodine balance definitely negative.

3. Notes on the Wanaka Soils and Pastures Analysed.

R. E R. GRIMMETT, Analyst, Chemistry Section, Department of Agriculture.

In November, 1929, the writer spent several days in the Wanaka area investigating the field conditions, and collecting soil and pasture samples. The following notes refer to the samples analysed by Miss Simpson (as set out in Table 3 in the preceding section).

Samples Z 1331 and 1332 are respectively red-clover green growth and red-clover hay from the same paddock near Lake Wanaka. This is on alluvial flats close to the base of the hills, and is not irrigated. The soil, in common with the rest of the flats, is of schistose origin and silty texture, with in places a stony subsoil. The top-dressing was 2 cwt. superphosphate in the spring of 1929 only. The hay is from the same stack that was used for feeding the ewes during the winter.

Z 1333 is a sample of general pasture from a paddock sown down for nine years. It is on the flats, but receives very little irrigation water. White and red clover with cocksfoot form the bulk of the pasture, which includes also rye-grass, fog hair-grass, Chewings fescue, crested dogstail, sweet vernal, Poa pratensis, suckling clover, and various weeds. The growth was green and of medium length, and had not been stocked during the previous fortnight. An iodide lick had been fed on this paddock.

Z 1334 is a sample of general pasture from a paddock, also on the flats, which has been irrigated for the last twenty years. The growth was fairly short and green, having had sheep on it for a fortnight. Rye and white clover were the principal constituents, together with cocksfoot, crested dogstail, red clover, Yorkshire fog, suckling clover, timothy, goose-grass, sweet vernal, and weeds The top-dressing was 1 cwt. of super and 1 cwt. potash salts, in the spring of 1928 only. An iodide lick was being fed on this paddock.

Z 1335 is a sample of self-established pasture from an unmanured and unirrigated paddock on similar soil to the preceding. The growth was mainly cocksfoot, fog, white and red clover, Poa pratensis, Chewings fescue, danthonia, sweet vernal, goose-grass, and weeds. No lick had been fed here.

At Makarora the rainfall is much higher, and the growth, especially of clovers, is very luxuriant. The soil is mainly alluvial, silty, and derived from schistose rocks. Z 1357 is a sample of general cow-pasture, very green and lush, predominantly white and red clover, together with cocksfoot, fog, rye, brown-top, crested dogstail, timothy, and weeds. This is from the farm where improved milk-yield and rearing of calves was reported following the feeding of iodine. Manurial history: 2 cwt. carbonate of lime and 1 cwt. super three years ago, 2 cwt. super last season, and 2 cwt. super and 1 cwt. sulphate of ammonia this season (1929–30).

Z 1358 is a sample of short green general pasture (cow and sheep) from a farm four miles farther up the Makarora Valley than the preceding. The paddock is twelve years old, and was manured with 2 cwt. superphosphate in 1927 and again in 1928. Rye, cocksfoot, and white clover predominate, other pasture constituents being fog, brown-top, Poa pratensis, timothy, Chewings fescue, rushes, cotula species, hydrocotyle species, and other weeds. No lick containing iodine had been fed on this farm.

Z 1359 is a sample of general pasture from an adjacent farm on which also no iodine had been fed. This paddock has been grassed for six years and was top-dressed in the spring of 1928 and in the autumn and spring of 1929, each time with $1\frac{3}{4}$ cwt. superphosphate. The pasture is predominantly white clover, with rye, timothy, crested dogstail, fog, cocksfoot, red clover, brown-top, sedges, and weeds

NOTE.—An account of the chemical composition of mica schist silts is given by Mr. B. C. Aston, Chief Chemist, Department of Agriculture, in this *Journal* for June, 1923, page 329.

EARLY-POTATO GROWING IN FRANKLIN COUNTY.

MANURIAL EXPERIMENTS AT PUKEKOHE, 1926 TO 1929.

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Notes on the Industry.

POTATO-growing is an important farming industry in Franklin County, and is carried out on the basic volcanic soil areas which form the northern boundary of the Lower Waikato Basin. The country consists of low rolling downs, rising occasionally into flat-topped volcanic cones, and was originally covered in heavy bush. The soil is extremely suitable for early-potato growing, being light in texture, dark red in colour, and naturally fertile. The volcanic area lies fairly near the sea, and does not suffer severely from frosts. On the elevated volcanic cones frosts seldom occur and are never severe The mean annual rainfall is about 50 in., and is well distributed. January and February are usually the driest months, and July and August the wettest.

Farms producing potatoes fall roughly into two classes — namely, "truck" farms of about 10 acres, which produce early potatoes, onions, and other vegetables, and dairy-farms on which potato-growing is a side line. The farms which produce the earliest potatoes are situated on the flat-topped volcanic cones, the chief of which is Pukekohe Hill, where the winter frosts are not severe and early potatoes can be safely planted in winter. The earliest crops are planted from the middle of May to the end of June. On the lower volcanic areas, where the crops cannot be planted with safety before July owing to winter frosts, the growing of second-early potatoes is combined with dairying. Naturally the dairy-farms are larger than the truck farms, and range roughly from 30 to 100 acres and over in area.

CROP-ROTATION AND CULTIVATION

On the small truck farms which grow the earliest potatoes the land is usually kept under cultivation for three or four years, and then sown in pasture for a year or two before being again broken up for another course of cropping. Potatoes are usually the first crop taken after grass, and the land is skim ploughed in the autumn, disked, and then deep ploughed and worked up to a fine tilth with disks and harrows ready for planting in May or June. The early-potato crop is dug in September–October, and is followed by a second crop which is planted in November–December and dug in March–April. Two crops a year may be thus grown for three or more years in succession. The rotation, however, is frequently varied by growing onions, carrots, or cabbages in place of potatoes. Catch-crops of barley, lupins, or white mustard for green-manuring are often grown after the second crop

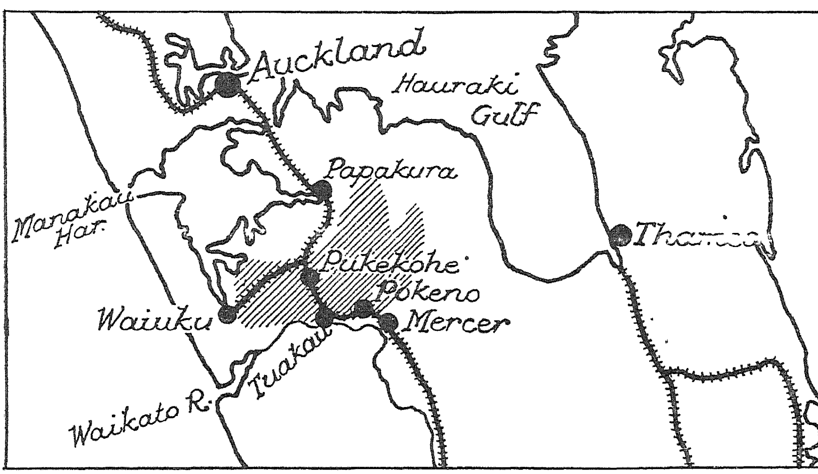


FIG. 1. MAP OF CENTRAL AUCKLAND DISTRICT, SHOWING EARLY-POTATO-GROWING AREA IN FRANKLIN COUNTY (SHADED).

On the dairy-farms potatoes are grown in rotation with grass supplementary annual crops, such as mangels and soft turnips. The potatoes are planted in July–August and dug in November–December. Mangels and soft turnips usually follow the potatoes, the mangels being sown early in specially prepared beds and transplanted after the potatoes are dug. The inclusion of potatoes in the cropping rotation on dairy-farms provides a valuable cash crop, which helps materially to reduce the cost of production of roots and green crops grown for the supplementary feeding of dairy cows.

For early crops, with which the haulms do not grow to a normal size, the potato sets are planted 9 in. to 12 in. apart in 27-in. rows. For the later-sown crops the sets are planted 12 in. to 15 in. apart in 33-in. rows. On truck farms the sets are usually hand-planted in furrows after the single-furrow plough, but the ridge plough is also used to some extent for planting. The fertilizer mixture is broadcast by

hand along with the sets. On dairy-farms and on level areas mechanical planters and diggers are often used in place of hand labour. As soon as the crop is up it is hand-hoed, and when the rows can be distinctly seen horse-hoed, followed later by another horse-hoeing and finally a moulding.

Varieties and Seed

Northern Star (Gamekeeper) is about the only variety grown. It withstands late blight fairly well, and suits the double-cropping system. Many attempts have been made in the past and are at present being made to replace Northern Star by other varieties, but no other variety has yet been established as a serious rival Before the incidence of late blight other varieties, such as Up-to-date, were grown at Pukekohe, but are now found to be unsuitable. Any variety to succeed there must be resistant to late blight and be suitable for double cropping.

Large cut seed, which provides a reserve of plant-feed and gives the young plant a good start, is used for planting the early crop. From this crop small tubers are usually selected for seed for the second crop. These are greened in the sun, and the stem end cut just before planting. Growers contend that cut seed begins growth earlier than uncut seed, and cut seed is almost universally used. The produce from the second crop planted with small seed is usually all sold, and the seed for the early crop is obtained by planting a special area of the second crop with large cut sets. This area is harvested early, and the large tubers are used for planting the following early crop. Some of the seed picked from the second crop is not planted for the early crop, but is "kept over" and planted immediately after the early crop is dug in September and October, to be dug in January and February. The seed from this crop is not saved for further cropping, as its vitality is considered to be lowered by this practice.

Disease and its Control.

The potato-plant being subject to many diseases, it might be expected that the continuous growing of potatoes would result in grave deterioration of the lines used at Pukekohe. The care taken by the growers with their seed, and the practice of digging the crop while the tubers are immature, are primarily responsible for the limited prevalence of virus and other diseases in the crops. There is very little disease evident in the first crop, but wilt diseases show up to a certain extent in the second crop. Epidemics of "mattery eye" have occurred in the past to such an extent that growers fear it more than any other disease. The practice of cutting the seed potatoes, enabling the growers to reject tubers with a discoloured vascular ring, has no doubt helped in reducing the incidence of wilt diseases.

The humid climate is responsible for heavy yearly attacks of late blight, but this disease is usually kept in hand by spraying with bordeaux or burgundy mixtures Spraying commences when the plants are 3 in. high, and is repeated at ten- or fourteen-day intervals, depending on the weather. Early blight sometimes makes an appearance, but is of no importance.

The potato-moth is fairly prevalent, and is encouraged by the quantity of potatoes left about in the fields every year. The grubs

may cause a certain amount of damage to stored seed, and precautions have to be carried out to prevent the moths laying their eggs on tubers stored for seed from the second crop.

HARVESTING AND DISPOSAL OF CROP.

Prices for early potatoes are highest in the early spring, and in favourable localities growers endeavour to produce crops which can be harvested as early in the spring as possible. The crops, however, cannot be harvested at too young a stage, since the produce will spoil in a few days and have a bad appearance when marketed. The crop can be harvested with safety when the tops are still green but have not reached their maximum growth, and some of the bottom leaves are just beginning to die. At this stage the eyes of the Northern Star (Gamekeeper) potato take on a pink tinge, and many growers judge the time for digging their crop by this sign.

The early crops on the hills are dug by gangs of Maoris, men and women, in charge of a responsible Maori man, who keeps a tally of the work of each digger and makes arrangements for the work and food. The grower usually supplies the food for the gangs while digging is in progress, and deducts the cost from the diggers' wages. The diggers are paid from 9d. to 1s. 6d per bag, according to the crop and the market price of potatoes The later crops on the lower flat land are sometimes dug with mechanical diggers, but hand digging is the usual practice

The potatoes are picked up in two grades, and packed in bags, the full weight of which is 60 lb. Both grades are sold in the case of the very early crop, but later in the season, when the price of second grade falls to the price of seed size, they are kept by the grower for seed for further planting.

The early potatoes are sent all over the North Island, and as far south as Greymouth and Dunedin. The price received for early potatoes in September averages about £30 per ton; it drops rapidly as supplies increase, and by the end of October usually falls to about £18. By the end of November the price has fallen to about £5 a ton and remains at this level till the winter.

Manurial Experiments at Pukekohe.

SUMMARY OF EXPERIMENTS IN 1926, 1927, AND 1928.

In the early days of potato-growing at Pukekohe, soon after the land was cleared, no manuring was necessary, but after the virgin fertility was exhausted increasing quantities of fertilizers were used. At the present time 15 cwt. to 20 cwt. per acre of mixed fertilizers are used for the early crop, and 10 cwt. to 15 cwt. for the second. Until recently bonedust, dried blood, and nitrogenous guanos were the chief fertilizers used, but now increasing quantities of superphosphate and sulphate of ammonia are being used to replace the more expensive and less efficient bonedust and dried blood.

Experiments in the manuring of potatoes at Pukekohe were started by the Department of Agriculture in 1926, and were continued in 1927, 1928, and 1929. Reports on the earlier experiments were published in this *Journal* for March, 1927, and June, 1928. The object of these

experiments was to measure the usefulness of various phosphatic manures and to ascertain whether bonedust could be economically replaced by a cheaper phosphatic fertilizer.

In the 1926 trials the fertilizers compared were 15 cwt. bonedust, a mixture of 7½ cwt. superphosphate and 7½ cwt bonedust, and another mixture of 7½ cwt. super and 7½ cwt Ephos phosphate, per acre Bonedust contains about 4 per cent. of nitrogen, and sufficient sulphate of ammonia was added to the other phosphatic fertilizer mixtures used in the trial to make up their deficiency in nitrogen. In addition 2 cwt. sulphate of potash was added to each mixture. The results of this trial are given in Table 1, from which it may be seen that bonedust can be quite well replaced by super and Ephos, and that super is probably a more efficient phosphatic fertilizer than bonedust. However, it should be noted that the super and Ephos mixture contained its nitrogen in a water-soluble form, whereas the bonedust contained it in a slower-acting form, and later trials have shown that water-soluble nitrogen is very important in the manuring of the early potato crop.

Table 1.—Summary of Results for 1926, 1927, and 1928.

Year	Fertilizer.	Yield of Table Potatoes. Tons	cwt	lb.
1926	15 cwt bonedust (1)	5	13	101
	7½ cwt bonedust and 7½ cwt super (2)	6	6	90
	7½ cwt Ephos phosphate and 7½ cwt. super (3)	6	9	0
1927	7½ cwt bonedust and 7½ cwt super (2)	2	1	49
	7½ cwt Ephos and 7½ cwt super (3)	2	4	61
	15 cwt super (3)	2	5	80
1928	7½ cwt. bonedust and 7½ cwt super (2)	3	13	2
	7½ cwt Ephos and 7½ cwt super (3)	3	13	67
	15 cwt super (3)	3	15	22
	4¾ cwt Diammonphos (1)	4	5	45
	7½ cwt Gafsa phosphate and 7½ cwt. super (3)	3	14	67

(1) Plus 2 cwt sulphate of potash
(2) Plus 2 cwt sulphate of potash and 1⅝ cwt. sulphate of ammonia.
(3) Plus 2 cwt. sulphate of potash and 3⅓ cwt. sulphate of ammonia.

In 1927 the trials were carried a stage further, and the manurial treatments used were 7½ cwt. bonedust and 7½ cwt. super, 7½ cwt. Ephos and 7½ cwt. of super, and 15 cwt. of super, per acre. Sulphate of ammonia and potash were also added to the mixtures, as in the 1926 trials. The results of these trials are also given in Table 1, and the relative yields were similar to those obtained in 1926. In 1928 these trials were repeated with additional treatments, in which Gafsa replaced Ephos in the mixture and Diammonphos replaced super and sulphate of ammonia. The Diammonphos treatment, when compared with the superphosphate mixture, increased the yield of table potatoes by 10 cwt. per acre. It contained nitrogen to the equivalent of 1·6 cwt. sulphate of ammonia more than the super mixture, but the phosphate content was less by an amount equivalent to 3 cwt. super. These trials indicated that the early potato-crop responded best to water-soluble phosphatic and nitrogenous fertilizers, and that expensive bonedust could be economically replaced by them.

EXPERIMENTS IN 1929.

During 1929 three manurial experiments were carried out with early potatoes at Pukekohe. Experiments were laid down on the farms of Messrs. E. J Campbell and G. T. Nicholson to determine the value of nitrogen and potash in addition to the basal phosphatic dressing of 15 cwt. super per acre. Another experiment was laid down on Mr. P. A. Miller's farm to determine the effect of different degrees of concentration of manure in proximity to the plant, and whether delaying a portion of the super dressing was beneficial. To ensure accuracy each treatment was replicated ten to sixteen times.

TRIAL ON E J. CAMPBELL'S FARM.

The experimental area on this farm was planted on 30th May, and the crop was dug and weighed on 21st October. The manurial treatments per acre were as follows :—

(1) Superphosphate 15 cwt.
(2) Superphosphate 15 cwt , sulphate of potash 2 cwt , sulphate of ammonia 2 cwt
(3) Superphosphate 15 cwt., sulphate of potash 2 cwt., sulphate of ammonia 4 cwt.
(4) Superphosphate 15 cwt., sulphate of potash 2 cwt , sulphate of ammonia 6 cwt
(5) Superphosphate 15 cwt., sulphate of potash 4 cwt., sulphate of ammonia 4 cwt

Before digging the rows manured most heavily with sulphate of ammonia could be picked out quite easily, the tops being heavier and of a healthy green colour. The yields from the different treatments are given in Table 2, from which it can be seen that the addition of sulphate of ammonia to the basal phosphatic dressing has materially increased the yield. Comparing the yields from treatments 3 and 5 it is evident that increasing the sulphate of potash to 4 cwt. per acre has

FIG. 2. WEIGHING YIELDS FROM EXPERIMENTAL AREA ON MR CAMPBELL'S FARM, 21/10/29.

decreased the yield below that resulting when only 2 cwt of potash was used with the same amount of phosphates and nitrogen. The last column in the table gives the per-acre value for the increased yield over treatment 1—the value of the extra manure, extra bags, and cost of digging and carting being deducted from the gross value of the additional table potatoes The trial clearly indicates the value of sulphate of ammonia as a fertilizer for early potatoes. The high price obtained for early potatoes makes it possible to economically use fairly large quantities of this fertilizer, and in this trial the application of 6 cwt per acre paid very well.

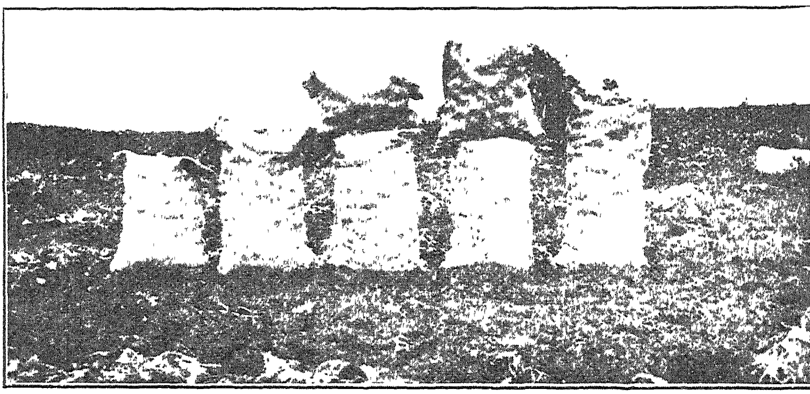


FIG. 3 PRODUCE OF DIFFERENT MANURIAL TREATMENTS ON MR CAMPBELL'S FARM.

Left to right: (1) Super, 15 cwt.; (2) super, plus potash 2 cwt and ammonia sulphate 2 cwt., (3) super, plus potash 2 cwt and ammonia sulphate 4 cwt.; (4) super, plus potash 2 cwt and ammonia sulphate 6 cwt.; (5) super, plus potash 4 cwt and ammonia sulphate 4 cwt —all per acre. Photo taken 21/10/29.

Table 2.—Results in E J. Campbell's Trial.

Treatment	Yield per Acre. First Grade.	Yield per Acre. Second Grade.	Increase of First-grade Potatoes over No. 1 Treatment.	Net Value of Increase per Acre over No. 1 Treatment.* £	s.	d.
	Tons.	Tons.	Tons.	£	s.	d.
(1) Super 15 cwt.	3·02	0·79	..		..	
(2) Super 15 cwt., potash 2 cwt., ammonia 2 cwt.	3·91	0·79	0·89	14	0	0
(3) Super 15 cwt., potash 2 cwt., ammonia 4 cwt	4·65	0·74	1·63	27	0	0
(4) Super 15 cwt, potash 2 cwt., ammonia 6 cwt.	5·11	0·80	2·09	35	0	0
(5) Super 15 cwt, potash 4 cwt., ammonia 4 cwt.	4·30	0·72	1·28	19	0	0

* First-grade potatoes from this crop sold at £23 per ton.

G. T. NICHOLSON'S FARM.

This experiment was planted and manured on 29th May and dug on 25th October. The different treatments were as follows:—

(1) Superphosphate 15 cwt
(2) Superphosphate 15 cwt, sulphate of potash 2 cwt.
(3) Superphosphate 15 cwt, sulphate of potash 2 cwt, sulphate of ammonia 4 cwt
(4) Superphosphate 15 cwt, sulphate of ammonia 4 cwt.
(5) Superphosphate 4·6 cwt, sulphate of potash 2 cwt., Diammonphos 4 cwt

As in the preceding trial the rows which had received nitrogen could be easily picked out before digging. The yields obtained from the different treatments are given in Table 3. Treatments 1 and 2 do not differ significantly from one another; treatments 3, 4, and 5 do not differ significantly from one another, but all are significantly better than treatments 1 and 2 Potash has had no beneficial effect on the yield. The value of sulphate of ammonia in increasing the yield is again demonstrated. Treatment 5 has the same quantity of phosphates, nitrogen, and potash as treatment 3, but part of the phosphate and all the nitrogen is in a different form: there is no significant difference in the yield.

Table 3—Results in G T Nicholson's Trial.

Treatment.	Yield per Acre		Increase of First-grade Potatoes over No. 1 Treatment.	Net Value of Increase per Acre over No. 1 Treatment.*		
	First Grade.	Second Grade				
	Tons	Tons.	Tons.	£	s.	d.
(1) Super 15 cwt	4·6	0·52	..		..	
(2) Super 15 cwt, potash 2 cwt. ..	4·38	0 54	0·22†		..	
(3) Super 15 cwt., potash 2 cwt, ammonia 4 cwt.	5·32	0 51	0·72	8	0	0
(4) Super 15 cwt, ammonia 4 cwt	5·32	0·55	0·72	9	0	0
(5) Super 4·6 cwt., potash 2 cwt., Diammonphos 4 cwt	5 22	0·57	0·62	4	0	0

* First-grade potatoes from this group sold at £20 per ton. † Decrease

FIG. 4. PART OF EXPERIMENTAL PLOT ON MR. NICHOLSON'S FARM.

Left of centre: Rows treated with super 15 cwt., potash 2 cwt., and ammonia sulphate 4 cwt. Right of centre: rows treated with super 15 cwt. and potash 2 cwt.—all per acre. Photo taken 26/8/29.

P. A MILLER'S FARM.

This third trial was set out to determine whether heavy applications of water-soluble fertilizers in direct contact with the potato sets had any deleterious effect on the initial establishment of the crop The experimental area was planted on 10th June and dug on 1st November. The crop was manured with a mixture of 15 cwt. superphosphate, 2 cwt. sulphate of potash, and 4 cwt. sulphate of ammonia, per acre, and the fertilizer was applied in the following ways: (1) In a narrow band 3 in. wide, with the potato sets; (2) in a broad band 9 in. to 12 in. wide, with the sets; (3) a mixture of 7 cwt. super, 2 cwt. sulphate of potash, and 4 cwt sulphate of ammonia in a broad band 9 in. to 12 in. wide, with the sets, and the remaining 8 cwt. of super applied when the crop was up, on 14th September, as a top-dressing.

The yields from the different treatments are shown in Table 4. No. 1 treatment is significantly superior to treatments 2 and 3, which do not differ significantly from one another. No bad effect on establishment of the sets was noticed for No. 1 treatment. Hence the close proximity of the manure to the potato sets was definitely advantageous in this trial.

Table 4.—Results in P. A. Miller's Trial.

Treatment.	Yield per Acre.	
	First Grade	Second Grade.
	Tons.	Tons.
(1) Manure in narrow band with sets	5·27	0·66
(2) Manure in wide band with sets	4·65	0·63
(3) Part of manure in wide band with sets, and part top-dressed later	4·77	0·65

RECOMMENDATIONS TO PUKEKOHE GROWERS FOR EARLY CROPS.

(1) Use a mixture of 12 cwt. to 15 cwt. superphosphate and 4 cwt. to 6 cwt. sulphate of ammonia, per acre, or

(2) Use 4 cwt. to 6 cwt. Diammonphos per acre. (The respective prices of these fertilizers should determine which is to be used.)

(3) The inclusion of about 2 cwt. potash per acre is an established practice in Franklin County. In the experiments conducted in 1929 potash was of no value in increasing yield, and there was no evidence to show that it conferred other benefits. However, further experimental evidence is required before the Department is prepared to advocate the exclusion of potash, the use of which for potatoes is normally regarded as a good practice.

(4) Do not distribute the manure too widely in the rows; the indications are that it is better to put it in a narrow strip a few inches in width along the row of sets.

NOTE.—It must be clearly understood that these recommendations may be subject to modification as further evidence is gained from experiments.

The writer wishes to record his thanks to Messrs. Nicholson, Miller, and Campbell for their helpful co-operation in carrying out the 1929 manurial experiments.

AN ECONOMIC SURVEY OF DAIRY-FARM GROUPS IN NORTH AUCKLAND, SEASON 1927–28.

E. J. FAWCETT, M.A (Cambridge), Farm Economist, Department of Agriculture.

Introduction.

IT is intended in two articles to give a short analysis of data from two groups of dairy farms in the North Auckland Land District. The present article deals with sixty-nine farms at Ruawai, in Otamatea County; the second will deal with a group of one hundred and eleven near Dargaville, in Hobson County, which adjoins Otamatea.

In order to facilitate comparisons, the system of analysis employed has been kept uniform with that used in the Department's Bulletin No. 138, "Dairy-farm Management," dealing with Waikato and Taranaki dairy-farms. Figures relative to per-acre production, cows milked per hundred acres, production per cow, area, &c., are tabulated from different angles, each factor being taken as a basis of grouping in turn to show its relative importance compared with other broad management practices. All subsequent tabulations dealing with finance, &c., are shown from one angle only—namely, by grouping data according to butterfat production per acre of productive land. In practically every instance a comparable table will be found for the Waikato and Taranaki farms in Bulletin 138 (which may be obtained free of charge on application to the Department).

The field-work in conjunction with this survey was done by Mr. O. C. Ormerod, of the Department of Agriculture. The manner in which farmers co-operated with him in supplying the necessary data is greatly appreciated by the writer.

GENERAL CONDITIONS PERTAINING TO DAIRY-FARMING IN THE DISTRICTS SURVEYED

Before going into the detailed analysis of figures it is essential to review some of the main features met with in the area under discussion. The same observations may be taken to apply to both the Ruawai and the Dargaville farms.

The development of dairy-farming on modern lines in North Auckland is a comparatively recent movement, and it cannot be expected that the average position should be strictly comparable with that of old-established dairying centres. The difficulties met with are great and varied, and in some instances are peculiar to this district. For many years development was slow, owing mainly to the system of land-settlement pertaining in districts where kauri-gum has been the main source of income. Improved transport facilities, combined with the demand for land following the war, and, consequent upon price-inflation, the necessity for better exploitation of land, has rapidly altered the position in the last few years.

Land Formation.—Practically all the farms surveyed consist of marine or alluvial deposits with a certain amount of clay and loam, and can be described as all flat country. Drainage is difficult owing to tidal water, and subsidiary drainage is lacking, due mainly to

initial cost. Consequently the land is waterlogged in the winter and early spring, giving a comparatively late spring growth and necessitating the wintering-off of cows in most instances.

Pasture Types and Management.—Conditions are very suitable for the establishment of high-grade pastures under careful management, paspalum, rye-grass, cocksfoot, crested dogstail, white clover, and lotus major being present in most swards. Top-dressing is not so prevalent as could be wished, but is steadily increasing. There is a great amount of speculation as to the advantages of different types of manures, and to the use of fertilizers generally. Subdivision of paddocks and rotational grazing is being recognized as an advantage in pasture and weed control. On strong land of this type, especially where one of the main grasses is paspalum, small paddocks are a necessity if pastures are to be controlled. The movement in top-dressing is probably disturbed owing to abortive results being obtained on many areas badly drained and carrying rank grass-growth. Rushes and pennyroyal are prevalent, and are a cause of restricted production or recurring expense Tall fescue is a constant menace on many farms, and is responsible for a considerable loss of cattle. It is particularly difficult to eradicate on swamp-land infested with logs and stumps. The Ruawai farms are fairly well provided with shelter-belts, but those of the Dargaville group are lacking in this respect.

Cow Types and Disease.—Dairy stock has been built up to a large extent on a foundation of Shorthorn cattle. At the present time Jersey, Shorthorn, Friesian, and Ayrshire strains are prominent, with a tendency to a predominance of the Jersey. The average cow production is comparatively low throughout the North, doubtless as a result of the foundation stock used. This is gradually being overcome by the introduction of purebred bulls and in some cases heifers or cows of proved production strain, but the movement is retarded owing to the apparent prevalence of disease. It is thought that high-production animals are more susceptible than the hardier heavy types. An outstanding characteristic of the whole of the farms surveyed is the large number of medium-quality cows milked per given area, the underlying principle being that high production may be achieved by heavy carrying, and that if the necessity for culling for disease arises the loss in stock is not so serious as if only high-grade animals were depended upon. It is difficult to compare the incidence of cow-diseases with any other district, but undoubtedly the net replacement factor is of greater moment in Ruawai and Dargaville than is the case in the Waikato.

Wintering-off—The wet nature of the country makes the wintering of cattle on higher land most desirable, and this practice is common throughout the swamp areas. Partially developed gum-land and hill country adjoin the flats, and this close proximity of the two types of land facilitates the movement of cows. The usual practice is to remove all or part of the herd for a period of eight to ten weeks, the cost varying from 1s. 6d. to 2s. 6d. per head per week. By adopting this method a certain amount of poaching of the ground is avoided and pastures are allowed to come away without interruption, thus ensuring feed for early calvers, and the apparent carrying-capacity of

the farm is high. If it were not possible to winter at least a part of the herd off the farm, production from many swamp holdings would be materially reduced.

Unproductive Land.—A number of the farms have varying areas of unproductive land, but this is not so prevalent in Ruawai as in Dargaville. The average for Ruawai is approximately 4·1 per cent. of the total area occupied. This unproductive area consists mainly of undrained swamp or tall fescue, and affects seventeen farms in the Ruawai group The area affected has been carefully assessed and has been excluded from all tabulations.

The Climatic Bearing.

As a general rule, the rainfall of the North Auckland Land District is adequate and ideally distributed for the maintenance of permanent pastures in a high state of production at all times of the year. The volcanic land, particularly in Whangarei County, demands constant rain if production is to be maintained, but the swamp type on the West Coast can withstand partial drought conditions without such serious injury. Unfortunately the season under review was a bad one from the distribution viewpoint, although total precipitation was good; in fact, adjacent recording stations showed a total precipitation above the average, although Dargaville, the nearest station to the Ruawai area, shows a slightly subnormal total. Abnormally dry conditions were experienced during November, December, January, and March in Dargaville With the exception of February, precipitation below the average was experienced from October, 1927, to April, 1928, inclusive. Although it is impossible to gauge the effect of this dry period on the season's production, it is safe to assume that butterfat-yields on all farms were below the average, and this must be kept in mind when studying subsequent tables of results.

The following table gives the total rainfall and its distribution at Dargaville, Whangarei, and Auckland for the year 1927–28.

Month.	Dargaville.			Whangarei			Auckland.		
	Total Fall.	Number of Wet Days.	Average Rainfall	Total Fall.	Number of Wet Days.	Average Rainfall.	Total Fall.	Number of Wet Days.	Average Rainfall.
1927.	Inches.		Inches.	Inches		Inches	Inches		Inches
July	5·91	24	5·12	9·73	21	7·53	8·47	29	4·98
August ..	5·65	24	4·34	6 23	24	6·85	6·96	26	4·19
September ..	4·63	18	3 74	5·97	18	5·03	4·31	21	3·65
October ..	2·78	8	3·76	3·62	7	4·64	2·66	12	3·64
November ..	1·06	12	3·72	1·30	8	3·00	1·63	13	3 26
December ..	1·05	10	2·92	1·34	14	2·49	1·42	12	2·84
1928.									
January ..	0·07	5	2·97	1·52	9	4·08	0·20	3	2·66
February ..	3·46	3	2·99	3·18	6	4·46	1·61	5	3·06
March ..	1·65	9	2·31	6·18	10	4·52	3·45	11	3·03
April	2·65	10	4·04	7·83	13	4·45	4·90	21	3·46
May	8·00	23	6·42	11·73	21	7·84	10·42	30	4·50
June	6·93	21	5·11	12·67	19	6·22	5·84	22	4·91
Total ..	43·84	167	47·44	71·30	170	61·11	51·87	205	44·18

The following notes on the climate of North Auckland are supplied by Mr C J. Hamblyn, Instructor in Agriculture, Whangarei :—

A study of the figures giving the average rainfall for the months of December, January, February, and March, for Whangarei, Dargaville, and Kaitaia, over a period of ten years, would indicate that the total fall for each of these months should be adequate for the maintenance of good pasture-growth. The efficiency of this rainfall depends, however, more on the number of days on which rain falls and the distribution of the wet days. A closer study of the rainfall in North Auckland will show that, though the average fall per month during the summer is much the same as that for South Auckland, there are occasional seasons of very little summer rainfall; but the main point is the fact that the average number of days on which rain falls is about half the number given for South Auckland, and, moreover, the maximum fall for one day is generally much greater. Also, the summer rainfall is made up generally of short spells of heavy rain with long spells of much more intensive heat than elsewhere, so that the rain on a dry soil is not effective, though the total for the month may appear to be so. This applies to the soils of the Northern Wairoa basin, where, in addition, the summer rainfall is on the average a good deal less than that for Whangarei, where thunderstorms are much more prevalent.

These points, I think, have a direct bearing on the known fact that were farmers dependent on English pastures and without paspalum there would be generally a very distinct period of summer shortage of pasture-growth. It is through the use of paspalum, and not on account of the favourable summer rainfall, that pasture-growth is maintained during the summer. With paspalum, in spite of an adequate rainfall, there is a distinct early-spring shortage, but this is overcome on a great many farms by wintering-off and commencing the milking season later than would be the case were rye-grass dominant in the pastures.

1. Ruawai Group—Otamatea County.

Bounded by the Kaipara Harbour on one side, Otamatea County runs across the island to the east coast, and is joined by Rodney County on the southern and by Whangarei and Hobson Counties on the northern boundaries. The greater portion is undulating to hilly, the main dairying districts being on the low country adjoining Kaipara Harbour. Much of the undeveloped country is of the familiar gum-land type. The farms dealt with in this section of the survey are all in the Ruawai district, and represent perhaps the best of the dairying farms in the county.

The total occupied area of Otamatea County in 1928 was 237,615 acres, of which a comparatively small percentage was used exclusively for dairying. Of the area occupied, 159,244 acres were improved, consisting of 155,540 acres in grass, of which 433 acres were cut for hay or ensilage in the season under discussion. Some 2,611 acres were under the plough for cropping purposes, mainly preparatory to establishment of permanent pastures. The remainder represented orchards, plantations, &c. Stock in the county consisted of the following: Horses, 2,339; dairy cows in milk or dry, 18,141; other cattle and young stock, 24,156; sheep wintered, 1928, 74,144; pigs, 8,083. On a sheep-unit basis dairy cows represented 36·88 per cent. of the total stock carried.

The sixty-nine farms comprised in this analysis milked 3,102 cows for the 1927–28 season, or 17·1 per cent. of the total dairy cows in the

county Each farm was visited for the collection of data, and records have been checked in every possible way. A number of records have been discarded owing to ncomplete details.

BUTTERFAT PRODUCTION AND SIZE OF FARM.

The following four tables group the sixty-nine farms and present resultant data under the specified headings. It should be noted that all figures within groups have been computed on the unweighted average, and therefore may or may not cross-check.

Table 1.—Farms grouped according to Butterfat-production per Acre (Productive Area).

Butterfat per Acre—Range	Number of Farms in Group	Butterfat per Acre	Butterfat per Cow	Number of Cows milked per 100 Acres	Number of Cows milked per Farm	Productive Area	Non-productive Area	Total Area.
lb.		lb.	lb.			Acres.	Acres.	Acres.
160–179·9	5	167·2	241·1	69·7	54·0	76·8	..	76·8
140–159·9	8	147·7	225·3	67·1	50·0	76·5	8·0	84·5
120–139·9	10	129·3	224·5	58·1	50·5	87·4	2 4	89·8
100–119·9	14	108·0	207 4	53·0	48·4	91·3	2·0	93·3
80– 99·9	15	88·3	199·5	44·8	43·1	96·4	3·0	99·4
60– 79·9	9	73·7	184·2	40·6	31·9	75·1	2·1	77 2
40– 59·9	8	49·3	154·1	33·0	39·8	131·3	6·0	137·3

Table 2.—Farms grouped according to Cows milked per 100 Acres (Productive).

Number of Cows milked per 100 Acres—Range.	Number of Farms in Group	Number of Cows per 100-Acres—Average.	Butterfat per Acre	Butterfat per Cow.	Number of Cows milked per Farm.	Productive Area.	Unproductive Area.	Total Area.
			lb	lb		Acres.	Acres.	Acres.
80–89·9 ..	2	83·4	159·5	192·6	53·0	65·0	18·5	83·5
70–79·9 ..	14	71·9	146·6	204·0	51·3	71·2	5·3	76·5
60–69·9 ..	13	63 9	138·4	216·6	50·3	78·3	2·7	81·0
50–59 9 ..	16	53·5	114·9	214·9	58·4	110·4	2·0	112·4
40–49·9 ..	20	44·5	87·7	192·2	35·6	79·6	1·9	81·5
30–39·9 ..	10	37·0	71·6	193·4	31·3	84·9	1·9	86·8
20–29·9 ..	4	27·1	47·9	176·7	44·8	170·0	12·0	182·0

Table 3.—Farms grouped according to Butterfat-production per Cow.

Butterfat per Cow—Range.	Number of Farms in Group.	Butterfat per Cow—Average.	Butterfat per Acre (Productive).	Number of Cows milked per 100 Acres (Productive).	Number of Cows milked per Farm	Productive Area.	Unproductive Area.	Total Area.
lb.		lb	lb.			Acres.	Acres.	Acres.
275–299·9 ..	1	277·8	142·0	51·1	45·0	88·0	12·0	100·0
250–274·9 ..	5	256·3	136·6	53·1	43·8	88·6	..	88·6
225–249·9 ..	14	236·5	129·2	54·7	44·4	80·9	9·0	81·8
200–224·9 ..	19	211·8	114·7	54·0	52·1	95·5	2·1	97·6
175–199·9 ..	16	188·0	77·6	41·2	42·2	108·3	4·8	113·1
150–174·9 ..	8	166·3	99·2	59·7	36·6	64·1	9·8	73·9
125–149·9 ..	6	134·5	59·4	44·1	43·2	98·9	2·0	100·9

Table 4—Farms grouped according to Size of Farm (Productive Area)

Size of Farm—Range.	Number of Farms in Group.	Productive Area—Average.	Butterfat per Acre.	Butterfat per Cow	Number of Cows milked per 100 Acres	Number of Cows milked per Farm.	Unproductive Area.	Total Area
Acres		Acres	lb	lb			Acres.	Acres.
30–39·9 ..	2	34·0	120 7	187 8	67 1	22·0	18 5	52·5
40–49 9 ..	5	45·0	76·9	181 3	42·7	19·0	4·6	49·6
50–59 9 ..	13	53·8	110 2	210·8	51·7	27·7	..	53·8
60–69·9 ..	4	64 6	114·7	207·3	54·6	35·3	5·3	69 9
70–79·9 ..	13	73 7	107·4	213·3	50·4	37·1	2 8	76·5
80–89 9 ..	6	84·8	94 7	198·1	47·6	40·3	6·2	91 0
90–99·9 ..	2	94·0	113·6	196·5	57 6	53·5	1·0	95·0
100–109·9 ..	11	101·4	115·6	204·9	55·4	56·1	0·5	101·9
110–139 9 ..	5	124·6	104 1	194 6	51·4	63·4	4·0	128·6
140–199·9 ..	4	160·3	97·7	203·8	48·8	77·5	2·0	162·3
200–299·9 ..	4	258·8	78 3	198·6	38·4	96·8	10·0	268·8

The outstanding feature of the preceding tables is the apparent capability of milking a large number of cows on a given area. The two factors contributing to this are (1) the practice of wintering cows off the farm, and (2) any errors which may have been made in computing the area of land classed as unproductive, an underestimate tending to increase the capacity of productive land. The former reason is the major one, the practice undoubtedly contributing greatly to the success of dairying on swamp flats Without facilities for wintering-off, this class of land would not be so valuable as at present is the case. Apart from this feature, the tables bear out previous studies and support the contentions made in Bulletin No. 138 relative to the importance of the capacity to milk a larger number of cows on any given area in procuring heavy per-acre production. The area of farms is not apparently correlated with production in this group, this again probably being affected by wintering-off, thus allowing equal per-acre milking-capacity on all sizes of farms under comparable conditions.

Top-dressing and Labour.

The practice of heavy and systematic top-dressing has not yet become general in the Ruawai district. Many farms were not manured at all during the season under review, while many others top-dressed small areas only. Table 5 shows a very different position from that pertaining to the Waikato farms surveyed.

Although more manure is used per acre on the heavier-producing farms, it is apparent that there has not been sufficient applied to greatly influence milking-capacity. The quantity used per cow tends to fall, and any trend in manure used per pound of butterfat produced cannot be regarded as significant. Due to the presence of paspalum in the pasture sward and to the practice of wintering-off, milking-capacity does not show such a wide range of fluctuation as is found on the rye-grass farms of the Waikato and Taranaki districts, where all stock is maintained on the same area all the year. Top-dressing will therefore not show to full advantage in Ruawai till pastures are fully exploited, which should result in a

Table 5.—Manure used for Top-dressing: Farms grouped according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range	Amount of Manure			Lime per Acre (not included in Manure).	Number of Farms in Group
	Per Acre	Per Cow.	Per Pound of Butterfat.		
lb.	Cwt	Cwt.	lb.	Cwt.	
160–179 9	1·6	2·4	1·1	0·1	5
140–159·9	1·7	2·5	1·3	0·2	8
120–139 9	1·4	2·4	1·2	0·2	10
100–199·9	0·9	2 0	0·9	0·6	14
80– 99·9	1·0	2·4	1·4	..	15
60– 79·9	0 9	2·2	1·3	..	9
40– 59·9	0·6	2·0	1·4	..	8

still heavier carrying-capacity and higher herd-averages. An advance in top-dressing will in all probability synchronize with subdivision and with herd-improvement.

Table 6.—Labour: Farms grouped according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range	Labour Units per 100 Acres	Number of Cows milked per Labour Unit	Butterfat produced per Labour Unit.	Number of Cows milked per 100 Acres	Number of Farms in Group
lb.			lb.		
160–179·9.. ..	5·1	15·4	3,681	69·7	5
140–159·9.. ..	4 8	17·2	2,912	67·1	8
120–139·9.. ..	4·4	15·5	3,479	58·1	10
100–119·9.. ..	4·5	13·2	2,673	53·0	14
80– 99·9.. ..	4·1	12·5	2,497	44·8	15
60– 79·9.. ..	4·2	11·3	2,003	40·6	9
40– 59·9.. ..	3·4	11·5	1.756	33·0	8

The labour position illustrates to a great extent the stage of development arrived at on North Auckland dairy farms. A unit of labour represents one person, whether male or female, or children shown as employed whole or part time on the farm. The density of labour is much higher than on farms in a more advanced stage as found in the Waikato or Taranaki. This is due (1) to the heavy carrying-capacity of milking-cows owing to the wintering-off factor previously discussed, and (2) to a wider application of hand milking. The latter condition is being rapidly altered, which will bring the number of cows milked per unit more into line with the figure given in the discussion of Waikato and Taranaki farms. Although the number of cows milked and butterfat produced per unit of labour is at present low, the fact remains that the higher density of labour on high-production groups is utilized to greater advantage than is the case with low-production groups.

Gross Returns.

The gross returns from farms follow very closely the returns from farms of similar production-capacity in other districts, minor fluctuations being caused through profits from pig or cattle accounts.

There is a considerable amount of buying for cow-replacement owing to a heavy wastage from disease, and this has resulted in debit balances in many stock accounts The total returns are as follow —

Table 7.—Gross Returns: Farms grouped according to Butterfat-production per Acre (Productive)

Butterfat per Acre—Range.	Gross Returns per 100 Acres.	Number of Cows milked per 100 Acres	Gross Returns per Cow
lb.	lb.		£
160–179·9	1,215	69·7	17·43
140–159·9	1,163	67·1	17 33
120–139·9	981	58·1	16·88
100–119·9	804	53·0	15·17
80– 99·9	684	44·8	15 27
60– 79 9	501	40 6	12·34
40– 59·9	377	33·0	11·42

It will be seen that, although total returns are satisfactory, the result has been achieved by milking a greater number of lower-quality cows. This has been made possible by the density of available labour.

MAINTENANCE EXPENSES.

Expenses of maintenance include two items not experienced in previous surveys—namely, drainage rates and winter grazing. It will be seen that even including these items the total cost per 100 acres or per cow are considerably lower than is the case for farms of similar production in the Waikato and Taranaki districts. This is accounted for by lower expenditure on manures and all the other items except rates. Farms in the Ruawai district are undoubtedly run as economically as possible, but it is questionable whether it would not eventually pay to spend more on the working of the farms if a long view is taken of the position.

Table 8.—Expenses: Farms grouped according to Butterfat-production per Acre (Productive) (All Figures per 100 Acres)

Butterfat per Acre—Range.	Manure.	Rates.	Fences.	Cultivation	Power.	Winter Grazing.	Depreciation.	Sundries	Total.	Cost per Cow milked.
				Actual Cost.						
lb	£	£	£	£	£	£	£	£	£	£
160–179·9	47·2	53·1	9 3	4·5	26 2	31·6	24·9	23·7	220·5	3·16
140–159·9	48·4	57·1	12·5	13·8	28·5	46·8	28·9	26·4	262·4	3·91
120–139·9	41·6	52·5	9·0	18·3	17·6	30·6	17·9	14·6	202·1	3·48
100–119·9	32 4	47·8	13 9	8·8	17·3	33 6	18·2	16·2	188·2	3·55
80– 99·9	30·3	48·6	7 3	16·5	18·1	23 6	19·5	15 8	179·7	4·01
60– 79·9	24·2	51·3	15·0	10 7	17·8	24 6	19 8	16·1	179·5	4 42
40– 59·9	18·2	41·4	5·2	15·9	10·6	12 3	14·6	11·8	130 0	3·91
				Percentage of Total.						
lb.										
160–179·9	21·4	24·1	4·2	2·0	11·9	14·3	11·3	10·8	100	..
140–159·9	18·4	21·8	4·8	5·2	10 9	17·8	11·0	10 1	100	..
120-139·9	20·6	26·0	4·4	9·1	8·7	15·1	8·9	7 2	100	..
100–119·9	17·2	25·4	7·4	4·7	9·2	17·8	9·7	8·6	100	..
80– 99·9	16·9	27·0	4·1	9·2	10·1	13·1	10·8	8·8	100	..
60– 79·9	13·5	28·6	8·3	6·0	9·9	13·7	11·0	9 0	100	..
40– 59·9	14·0	31·8	4·0	12·2	8·2	9·5	11·2	9·1	100	..

Distribution of Gross Returns.

In Table 9 gross returns are broken up into maintenance expenses, labour reward, and interest surplus. Labour has been charged at £7 per cow milked, in order to effect uniformity with previous analyses. Owing to the heavy milking-capacity of farms in the higher groups particularly, the resultant labour figure appears very high. It must be remembered, however, that milking operations are heavy labour-demanders, and, even though it may be for a part of the year only, adequate help must be available when required if production is to be maintained.

Table 9.—Distribution of Gross Returns Farms grouped according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range	Number of Farms in Group.	Maintenance.		Labour.		Interest		Total	
		Per 100 Acres	Percentage of Total	Per 100 Acres	Percentage of Total	Per 100 Acres	Percentage of Total	Per 100 Acres.	Percentage.
lb		£		£		£		£	
160–179·9	5	220	18·1	488	40·2	507	41·7	1,215	100
140–159·9	8	263	22·6	469	40·3	431	37·1	1,163.	100
120–139·9	10	202	20·6	407	41·5	372	37·9	981	100
100–119·9	14	188	23·4	371	46 1	245	30·5	804	100
80–99·9	15	180	26·3	314	45·9	190	27·8	684	100
60–79·9	9	180	35·9	284	56·7	37	7·4	501	100
40–59·9	8	130	34·5	231	61 3	16	4·2	377	100

This table stresses the fact that it does not pay to run a low-production farm unless production is incidental to the stage of development of the land and shows a progressive increase. Low production and high capitalization are a fatal combination, and even if such farms are not highly capitalized considerable reserve capital is essential for development if the state of production is to be altered in a reasonable period of time.

Interest Surplus.

Accepting the foregoing break-up of income as reasonable, the interest surplus can be converted into capital as a guide to the production-value of land under the conditions experienced in this district.

Table 10.—Interest Surplus and Capital: Farms arranged according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range.	Number of Farms in Group.	Number of Cows milked per 100 Acres.	Interest Surplus per 100 Acres.	Gross Capital represented at 7 per Cent.
lb.			£	£
160–179·9 ..	5	69·7	507	7,240
140–159·9 ..	8	67·1	431	6,164
120–139·9 ..	10	58 1	372	5,319
100–119·9 ..	14	53·0	245	3,493
80– 99·9 ..	15	44·8	190	2,719
60– 79·9 ..	9	40·6	37	535
40– 59·9 ..	8	33·0	16	223

Gross capital covers land and improvements, stock and plant Therefore if the value of stock and land is subtracted one arrives at a figure on which the average farm in this district earns 7 per cent. interest after paying maintenance expenses and a labour reward on the basis of £7 per cow milked.

Table 11.—Capital Position Farms grouped according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range.	Number of Farms in Group	Number of Cows milked per 100 Acres	Gross Capital	Valuation of Stock and Plant.	Net Capital—Land and Improvements.	Value of Land and Improvements per Cow milked
lb.			£	£	£	£
160–179·9	5	69 7	7,240	1,178	6,062	86·97
140–159·9	8	67·1	6,164	1,220	4,944	73·68
120–139·9	10	58 1	5,319	945	4,374	75·28
100–119·9	14	53 0	3,493	901	2,592	48·91
80– 99·9	15	44·8	2,719	830	1,889	42·17
60– 79·9	9	40·6	535	806	− 271	..
40– 59 9	8	33·0	223	629	− 406	..

Those groups of farms having a high average production are earning on a per-acre capital basis quite comparable with that of farms in older-established districts, but they are doing so by milking a large number of cows, which reduces the capital value per cow milked. The falling-off is very rapid in low-production groups.

It is of interest to compare the capital value, as assessed above, with Government valuations. As is to be expected, these valuations are below the apparent earning-value on high-production farms, but on farms producing below 120 lb. of butterfat per acre they are considerably above. The variations in management efficiency and in farm improvements make it very difficult to assess a fair valuation for taxation purposes.

Table 12.—Valuations: Farms grouped according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range.	Number of Farms in Group	Value of Land and Improvements per 100 Acres.	Government Valuation per 100 Acres.
lb		£	£
160–179·9 ..	5	6,062	3,826
140–159·9 ..	8	4,944	4,263
120–139·9 ..	10	4,374	3,752*
100–119 9 ..	14	2,592	3,493†
80– 99·9 ..	15	1,889	3,459
60– 79 9 ..	9	− 271	3,419
40– 59·9 ..	8	− 406	2,960

* Eight farms † Twelve farms.

SUMMARY.

Dairying in the Ruawai district has developed along lines suited to conditions prevailing locally. Owing to the swampy nature of the country and availability of hill country adjoining, wintering-off occupies an important place in herd and pasture management. Owing to the

type of foundation stock used, and to the prevalence of disease, the average production per herd is not high, but is steadily improving. Wintering-off has enabled farmers to practise a heavy density of cows during the lactation period, and this system of management has resulted in heavy per-acre production on the more highly improved farms. Total returns are comparable with old-established farms in other districts; but this has been attained at the expense of labour. In other words, more labour is required to achieve the same capital result than is the case in Taranaki and the Waikato, where, owing to a higher production per cow, a lesser number gives the same butterfat total.

The fact that so many of the farms show a sound financial position is evidence that those at present below the average can be looked upon as potentially sound. Lack of capital is undoubtedly the major retarding factor, although misfortune has played its part on many holdings. Again, it must be remembered that the district suffered from a dry summer during the season under review.

(To be continued.)

FEEDING ENSILAGE TO SHEEP.

SOME SUCCESSFUL EXPERIENCES BY FARMERS.

MANY hundreds of New Zealand farmers are successfully and profitably feeding ensilage to dairy cows. This fact is prompting numbers to ask whether it is advisable to feed ensilage to sheep. Much light will be thrown on this matter by relating what had already been the experience in New Zealand of certain farmers who have fed ensilage to sheep.

South Island Experience.

Mr. C. V. Dayus, District Superintendent, Live-stock Division, Dunedin, gives the following particulars:—

Otautau.—Mr. R. Greenslade, of the Otautau district, Southland, fed oats and peas ensilage, at the rate of about 2 lb. daily, to sheep during the winter of 1929. The sheep did well, and Mr. Greenslade intends to continue using ensilage in this manner.

Queenstown.—Messrs. H. McKenzie and Sons, of the Queenstown district, also fed ensilage to hoggets during last winter. They are of the opinion that the hoggets did much better on it than other sheep did on hay, and they intend to make more ensilage in future.

Myross Bush.—Mr. H. C. Stevens, Myross Bush, near Invercargill, fed ensilage to 400 sheep during last winter, and intends to increase his ensilage supplies.

In respect to Mr. Steven's experience, Mr. G. W. Wild, of the Fields Division, Invercargill, reports as follows: In July it was decided to commence feeding out the ensilage. This proved to be of an excellent sweet green type from top to bottom. A mob of 400 in-lamb ewes had been selected for feeding. A timely fall of snow proved most opportune, as the ensilage, when thrown along the gorse hedge, was

FIG. I. SHEEP ON MR. STEVENS'S FARM, MYROSS BUSH, WAITING FOR ENSILAGE.
The rack seen in foreground had been filled the previous day

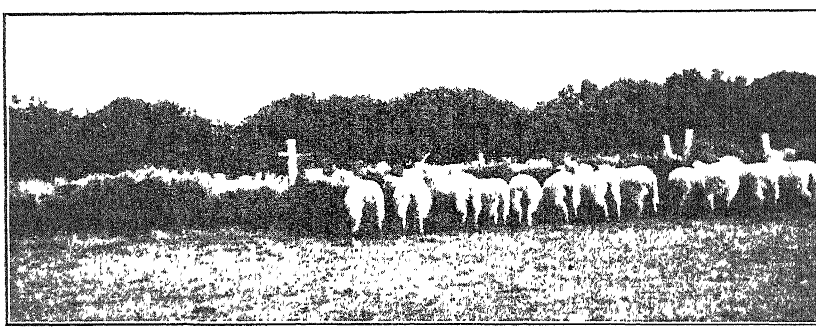


FIG 2 SHEEP FEEDING ON THE ENSILAGE
Note that the left end of the rack, containing hay, is receiving no attention

FIG. 3. EWES SHOWING KEENNESS FOR GOOD, SWEET, GREEN ENSILAGE.
[*Photos by G. W. Wild.*

quickly sampled and found palatable by the hungry ewes. Hoggets showed less inclination to take readily to the ensilage at the start, but this soon changed to wholesale liking. A V-shaped hay-rack constructed of wire netting was next erected It was decided to use half of this rack for hay and half for ensilage, the total length being approximately a chain. About 2 lb. of ensilage per ewe was allowed each day. The ewes showed decided preference for the ensilage. Mr. Stevens's opinion of the results he obtained with the ensilage may be judged from the fact that this season he has saved some 140 tons of grass ensilage in place of the 80 tons saved in the preceding year.

Mr. J Kerrigan, District Superintendent, Live-stock Division, Christchurch, advises :—

South Canterbury—Mr. Allen, of the Mackenzie County, who fed ensilage to hoggets, is of the opinion that they ate it readily and did very well on it.

North Island Experience.

Mr W C Barry, District Superintendent, Live-stock Division, Wellington, forwards the following notes :—

Hastings.—Messrs. Thompson Bros., of Ngatarawa, Hastings district, have fed considerable quantities of ensilage to their sheep, and are of opinion that by doing so they have practically doubled the carrying-capacity of the farm Mr Thompson, who supplied the information, does not claim that he can fatten sheep by feeding them on ensilage, but considers that it tends to keep them in good health. He thinks there has been less "bearing" trouble among the breeding-ewes since feeding with ensilage, and that the quality of the wool has improved. Ensilage from one pit fed 2,500 sheep from April to October. Mr. Thompson says the taste for ensilage by sheep is what might be termed an acquired one, but that once sheep have acquired it they come readily whenever they see the daily supply of ensilage arriving.

Karioi.—Mr. Black, of Karioi, Raetihi district, has been feeding 1,500 ewes on ensilage placed in racks situated in the run-off paddock from turnips. He states that the ewes do much better on it than when he was feeding hay with the turnips.

Taranaki.—In this district Mr. A. Turnbull has fed ensilage to sheep for several years, and states that slight digestive disorders have been experienced occasionally when feeding it to in-lamb ewes; in such cases has had to discontinue feeding it for short periods. Mr. Turnbull and another Taranaki farmer who has been feeding ensilage to sheep agree that it is necessary to have ordinary grazing for the sheep as well, the ensilage alone not being satisfactory.

Feilding.—Investigation of the experience of Mr. A. S. Brewster, Makino, Feilding, by Mr. R. P. Connell, of the Fields Division, disclosed the following most instructive results: Mr. Brewster wintered on his farm, which is devoted wholly to sheep, 1,110 four- to five-year-old crossbred Romney ewes. Up to docking-time there were thirty-one ewes lost by death. The lambs tailed represented 104 per cent. of all ewes wintered. Lambing difficulties did not at all show any unusual features. The wool obtained this season averaged 9½ lb. per ewe, and was of good quality and not characterized by breaks. The sales of fat lambs were the most striking feature of the farm. The

fat lambs sold from the flock up to 23rd December last represented 71 per cent. of the lambs reared. A number of these lambs were sold early for butcher's use, and the weights of these were not ascertained, but the main draft averaged 38·8 lb. The previous season's lambs from this farm averaged 37·7 lb. According to the estimates of leading local buyers for freezing companies, farms of similar good character to Mr Brewster's were, on the average, disposing of about 50 per cent. of their lambs as fats prior to Christmas, compared with Mr. Brewster's 71 per cent. Further, whereas generally the lambs drafted as fat were, on the average, 3 lb. to 5 lb. down in weight compared with the lambs from the same farms in the previous season, Mr. Brewster's lambs were 1 lb. up in weight. Hence, Mr. Brewster's results this season stand out both in respect to weight of lambs and relative numbers sold. During June and July and right up to lambing-time Mr. Brewster fed ensilage to the ewes at the rate of about 2 lb. daily. He considers ewes should be in good condition when first they are offered ensilage, as he found it necessary to practically starve them for some days before they could be forced to commence eating it, although once they made a start they continued consuming it quite readily, with the exception of a small number, which therefore were drafted out and attended to otherwise In feeding the ensilage to the ewes prior to lambing, Mr. Brewster ran them in lots of 400 at the rate of approximately 14 ewes to the acre. As the ewes lambed they were drafted into paddocks of fresh grass, which had been spelled for some of the time the ensilage was being fed. In mid-September Mr. Brewster's lambs were inspected, and then were very forward in comparison with others in the district. It would seem that the ensilage fed to the ewes acted in a twofold way: (1) The lambs were born in better condition and stronger than they would have been had the ewes been without ensilage; (2) the ewes were in better condition at lambing, and hence milked better after lambing. Mr. Brewster says of ensilage feeding to sheep: "It seems to me one of the coming methods of wintering a large number of ewes on a small acreage successfully. I shall be wintering my ewes on ensilage again this year."

Waverley.—Mr. F G. Ell, manager of Dr. Paget's farm at Waverley, courteously supplied details of his experience to the Director of the Fields Division. Mr Ell, who has been feeding ensilage to sheep for four years, commences feeding it in June and continues it until the end of September. He had some difficulty in getting the sheep started on it the first year. His method is to graze a couple of paddocks very hard with cattle, he then puts a flock of 1,000 ewes in one paddock and feeds out a ton of ensilage. In the other paddock he feeds out 1 ton of hay and about 2 tons of carrots, and then changes the ewes from one paddock to the other every second day or so for about a month. He always feeds ensilage in combination with hay or carrots. He estimates that the ewes consume about 2 lb. of ensilage daily. The average mortality among the ewes for the past four years was 1½ per cent., and the average wool clip 9 lb. The lambing percentages for the past four years were 101 in 1926, 109 in 1927, 117 in 1928, and 105 in 1929.

Rotorua--At the Prison Farm in the Rotorua district ewes were fed on grass and clover ensilage from the end of June to September. At first the ewes ate little of the ensilage, but after a week or so they looked for it

Summary.

From the foregoing record of the experience and opinions it is clear that ensilage is being fed successfully to sheep in various parts of New Zealand by a number of farmers. Points brought out in the experiences related may be summarized as follows:—

(1) Sheep, as might be expected, being shy, nervous animals, do not immediately consume a strange fodder such as ensilage, but once having become accustomed to it they consume it readily. Probably one of the best methods of inducing sheep to commence eating ensilage is to stock a relatively bare paddock heavily—at the rate of fifteen sheep or so to the acre—and then feed out the ensilage. After the first season of feeding there will usually be on hand sheep from the previous season which have consumed ensilage and which will act as leaders in eating it to those sheep to which it is being fed for the first time.

(2) Successful experience with ensilage has usually been the feeding of relatively small amounts daily—about 2 lb.—in conjunction with other forage. The experience does not disclose definitely whether larger amounts of ensilage could be fed with profit and without any danger of trouble, but until it has been shown what quantities can be fed to in-lamb ewes with safety it will be well for farmers giving the method a trial to feed not more than 3 lb. per ewe daily.

The Department of Agriculture will be glad to receive details of the experience of any other farmers who have been feeding ensilage to sheep.

—*Fields Division.*

STATISTICS OF IRRIGATED LANDS IN NEW ZEALAND.

Utilization of Irrigated Lands.	Area irrigated.	
	Year 1927–28.	Year 1928–29.
	Acres.	Acres.
Orchards	2,244	2,032
Green fodder and root crops	3,099	2,985
Pasture	50,201	53,104
Lucerne	1,290	1,061
Oats	316	365
Wheat	60	106
Barley	16	159
Market gardens	6	19
Other crops	8	14
Totals	57,240	59,845

—*Census and Statistics Office.*

THE CANARY GRASSES IN NEW ZEALAND.

H H. ALLAN and V. D ZOTOV, Plant Research Station, Palmerston North

OF recent years interest has been aroused in New Zealand concerning "Harding Grass" and its relation to "Toowoomba Canary-grass" and "Phalaris bulbosa." Kennedy*, writing in 1917, stated. "That much, if not all, of the seed of *Phalaris* now on the markets of New Zealand and Australia is hopelessly mixed seems to be certain, and also that a selection of the perennial species will have to be made before one can recommend the purchase of seed from these countries." He instances the fact that a sack of seed exhibited by the New Zealand Government at the Panama International Exposition, and labelled "*Phalaris bulbosa*," proved on sowing to be "an annual and not the desirable perennial grass called *Phalaris bulbosa* as received from South Africa."

The Director of the Plant Research Station asked us, therefore, to look into the matter of the systematics of the species of *Phalaris* found in New Zealand, whether as naturalized plants or as purposely sown. It was soon found that the synonymy of *Phalaris* species was much involved, especially as regards "*Phalaris bulbosa*." To make the situation clear, so far as it affects New Zealand, it is necessary for us to go somewhat into the history of the matter. We are greatly indebted to the Director of the Royal Botanic Gardens, Kew, for allowing Mr. C. E. Hubbard to devote much time to elucidating certain problems that we put to him. Without Mr. Hubbard's thorough and detailed report, and a series of authentically named specimens forwarded by him, we could not have arrived at definite decisions. We have also to thank the following gentlemen for very kindly forwarding information and specimens: Professor Dr. A. Béguinot, University of Modena; Professor P. B Kennedy, University of California; Professor Dr. G. E. Mattei, University of Messina; Mr. F. J. Rae, Government Botanist for Victoria; Mr. C. T. White, Government Botanist for Queensland; and Mr. J. W. Whittet, Agrostologist, Department of Agriculture, New South Wales.

ORIGIN OF TOOWOOMBA CANARY-GRASS.

There are two conflicting accounts of the introduction of this grass into Australia. R. R. Harding (as cited by Kennedy, *loc. cit.*, p. 2) says: "In 1883 I received twenty-one packets of seed from Italy. These I put in the nursery. All germinated, but the frost killed all except this wonderful grass, *Phalaris commutata* In two years it had taken possession of nearly the whole plot of ground in the nursery from the seed self-sown. It is a perennial. We had to remove the grass, so we dumped the root-clumps in a corner on hard ground, but it still grew to 5 ft. in height. This was during the drouth and frost, and although it was cut it grew again." Ewart (*Journ. Dept. Agric., Victoria*, Vol. 6, 1908, pp. 738–740) says: "Mr. Charles Ross, Manager of the State Farm, Westbrook, Queensland, however, informs

* "New Grasses for California: I. *Phalaris stenoptera* Hack." Univ. of Calif. Publications in Agric. Science, Vol. 3, No. 1, pp. 1–24, July 13, 1917.

me that it was introduced into Toowoomba over twenty years ago, when the late Mr. Way was Curator of the Botanic Gardens. The seed was received with about sixty other grasses from the Agricultural Department of New York, U.S.A. All the varieties were lost but this one, which existed in out-of-the-way places, such as hedgerows and rubbish-heaps." Ross at once began to progagate and distribute it. Harding also distributed it to all the colonies, Africa, and even Italy. Ewart suggests a third explanation: "We have no guarantee that the seed originally imported was pure, or, in fact, that the plant with which we are dealing was actually derived from imported seed at all. The gap of four or five years between the apparent loss of the seed and the reappearance of the plant on a rubbish-heap is a big one, and gives room to many possibilities." He suggests it may have been a hybrid between *P. arundinacea* and *P. canariensis*. It certainly seems possible that the grass actually propagated and distributed was an accidental introduction, and was not derived from the sowings of either Ross or Harding.

WHAT IS TOOWOOMBA CANARY-GRASS?

How the name *P. commutata* came to be applied to the Toowoomba grass remains obscure. *P. commutata* Roem. et Schult. was a name given to specimens collected in northern Italy. It seems certain that the species was based on the rhizome and leafy stems of *P. nodosa* Murp. (which is *P. tuberosa* L.), and an inflorescence of *P. minor* Retz. The name *commutata* has therefore been abandoned by taxonomists for any species of *Phalaris*. Ewart sent specimens of the Toowoomba grass to the Director of Kew and to Hackel, then the greatest European agrostologist. Hackel decided that he had a new species, the country of origin of which was unknown, and named it *P. stenoptera*, on account of the narrowness of the wings. He places it as intermediate between *P. bulbosa* and *P. arundinacea*. Hackel's description (in Fedde, *Rep. Nov. Spec. Regni Veg.*, Vol. 5, 1908, p. 333) includes the following points in which his *stenoptera* is held to be distinct from *bulbosa*: (1) the the narrower wings, (2) basal internodes not swollen, and especially (3) absence of the first sterile floret, with the second 1 mm. long.

Stapf reported of the specimens sent to Kew that they belonged to *P. bulbosa* L., the narrowness of the wings being attributed to the fact that the inflorescences sent were immature. He says (*Kew Bull.*, Vol. 37, 1909, p. 291) of later specimens, "The samples communicated by Mr. Maiden and Mr. Hedley Wood are fully developed and certainly confirm the determination of the grass as *P. bulbosa*. They differ from the typical Mediterranean plant known under that name in nothing but the stouter stems and altogether more luxuriant growth, and the obscure but still noticeable swelling of the basal internodes, a character to which the grass owes its name. The plant is, however, able to adapt itself to a great variety of external conditions, and the development of the vegetative parts varies accordingly. Fairly luxuriant specimens with slightly swollen basal internodes are extant in the Kew collections from Algeria, representing a strain such as might have given rise to the luxuriant Toowoomba race." As to the spikelets, Stapf says, "The condition and number of the 'sterile glumes' in the Toowoomba grass is, however, exactly the same as in *P. bulbosa*. . . [the first sterile

floret] is represented by a small cartilaginous scale with a tiny membranous appendage; [the second] by a similar slightly larger scale with a linear-subulate appendage, which reaches up to $\frac{1}{3}$ or almost $\frac{2}{5}$ of the last glume which is fertile."

Kennedy (*loc. cit.*, pp 3–5) after comparing his specimens, apparently derived from seed from South Africa, with the "original" description of *P. bulbosa* concluded that they could not be referred to that species. Unfortunately he does not state what "original" description he had used. Assuming that it was the description of Linnæus, it will be seen from what follows that one can well understand why Kennedy could not accept it as treating of the Toowoomba grass. He decided that Hackel's "excellent detailed description" of *P. stenoptera* "agrees with our grass from South Africa in everything but the sterile florets." As to these, his statements agree pretty well with those quoted from Stapf. Kennedy therefore accepts Hackel's name, and suggests the popular name "Harding Grass" in place of the unwieldy "Toowoomba Grass." But Hackel's statement concerning the sterile florets of his specimens is the crucial point in the differentiation between *P. stenoptera* and *P. bulbosa*, and if this is so far from the truth his species appears to fall to the ground. As an explanation of the difficulty, Kennedy offers this suggestion: "Hackel mentions that he received the plants and seeds from which he drew up the original description of *Ph stenoptera* from A. J. Ewart, of Melbourne. Since the seeds of at least two species are so hopelessly mixed in Australia, is it not just possible that the seeds sent to Hackel may have been the annual species, which constantly has only one sterile floret, and that the plants were those of *Ph. stenoptera*, the perennial species?" So experienced a taxonomist as Hackel is most unlikely to have missed the actual facts concerning the specimens in front of him, and Kennedy's suggestion provides a very possible explanation. But, if it be the true one, *P. stenoptera* becomes a case identical with *P. commutata*, and the name should be abandoned. Kennedy also suggests, as Ewart had done, the possibility of a hybrid origin for Toowoomba grass.

We have examined material collected in various parts of New Zealand, and have compared it with specimens from Australia Among these we have a sheet collected by Charles Ross on the Reformatory Farm at Westbrook, and one collected by J. Liverseed on the State Farm, Hermitage, near Warwick. This last specimen is a duplicate of material examined by Stapf. We have also specimens from Sicily and the Island of Rhodes. We have also grown specimens from seed collected in New Zealand, and from seed kindly supplied by Mr. Kennedy. We have seen plots also grown from seed originating with Mr. Kennedy. Our findings agree with those of Stapf, and we consider Toowoomba grass (Harding grass) and the European grass generally referred to as *Phalaris bulbosa* to be one and the same species. Both in specimens from New Zealand and from American seed there are slight differences in individual plants as to degree of robustness and development of the basal swellings, but we do not find swellings altogether absent. Conditions of growth and cultivation naturally have considerable influence on the development of the plants. Older plants from long-established pastures have a greater tendency to rhizome-development and to swelling of the basal internodes. We do not wish to deny that in Toowoomba grass there may be more than one distinct race, with

possibly distinct agricultural values. Indeed, we think it quite likely that intensive study would reveal such races, but that even then botanically they should be treated as at most varieties of a single species. The hybrid idea was attractive to us, but we have seen nothing that in any way supports it. Nor have we observed hybrids with *P. minor*.

WHAT IS PHALARIS BULBOSA?

In the foregoing we have used the name *bulbosa* as for the grass of the Mediterranean region. This is the sense in which it is used by Stapf and Hackel, and by the generality of European taxonomists, whether with or without the name of Linnæus attached But there is grave doubt whether the name *bulbosa*, as thus used, applies to the grass originally described by Linnæus. The synonymy is complicated, and we propose merely to give what appear to be the essential facts that emerge, following Mr. Hubbard's researches.

P. bulbosa L., *Cent. Pl.* i, 4 (1755); *Amoen. Acad.* IV, 264 (1759). This is the earliest and only valid use of the name *bulbosa*. The specimen in the Linnean Herbarium named *P. bulbosa* in the handwriting of Linnæus is the plant now known as *Phleum tenue* Schrad., and not a *Phalaris*. To this specimen the description of Linnæus applies much better than to the Mediterranean *Phalaris*, and the statement of distribution, "in Oriente," also agrees with *Phleum tenue* and not with the *Phalaris*. The name *bulbosa* should therefore be abandoned. Linnæus described the Mediterranean plant under the name *P. tuberosa* in *Mant.* ii, 557 (1771). The species is based on the description by Morison of his "Phalaris perennis major radice nodosa" in *Plant. Hist. Oxoniensis*, iii, 187 (1699). There is a specimen so named in the Linnean Herbarium. This is the species to which the name *bulbosa* has commonly been applied. The name *P. aquatica* L. has also to be considered. It is by no means clear whether this name is to be applied to *P. tuberosa* L. or to *P. caerulescens* Desf. Added to this is the fact that the terms *bulbosa* and *aquatica* have both been applied as specific epithets by different authors to a number of different species (both, for example, have been used for *Phalaris minor* Retz.). The clear and legitimate solution of the tangle appears to be to reject both *aquatica* and *bulbosa*, as being "nomina confusa." This leaves us free to adopt the name *P. tuberosa* for the species we are considering, to which alone it has been applied.

SPECIES OF PHALARIS OCCURRING IN NEW ZEALAND.

We supply a key to the species we have observed in New Zealand, and add remarks on each. The following notes, together with the illustrations, will enable the uninitiated to understand the terms used. The flowers are developed in panicles of spikelets, each spikelet being stalked. The panicles may be arranged with the branches somewhat widely spreading (as in *P. arundinacea*, Fig 1, *a*), or closely compacted, the whole inflorescence then having a spikelike appearance (Figs. 1 *b*, *c*, *d*, *e*). Each spikelet is composed of the following parts: Two large husks (glumes) enclosing the florets (Figs. 2, *a–e*); a fertile floret with hardened, rather shining, more or less hairy husks (Figs. 2, *f–m*); one or two sterile florets at the base of the fertile one, composed of small shining scales with or without an appendage (Figs. 2, *f*, *g*, *l*).

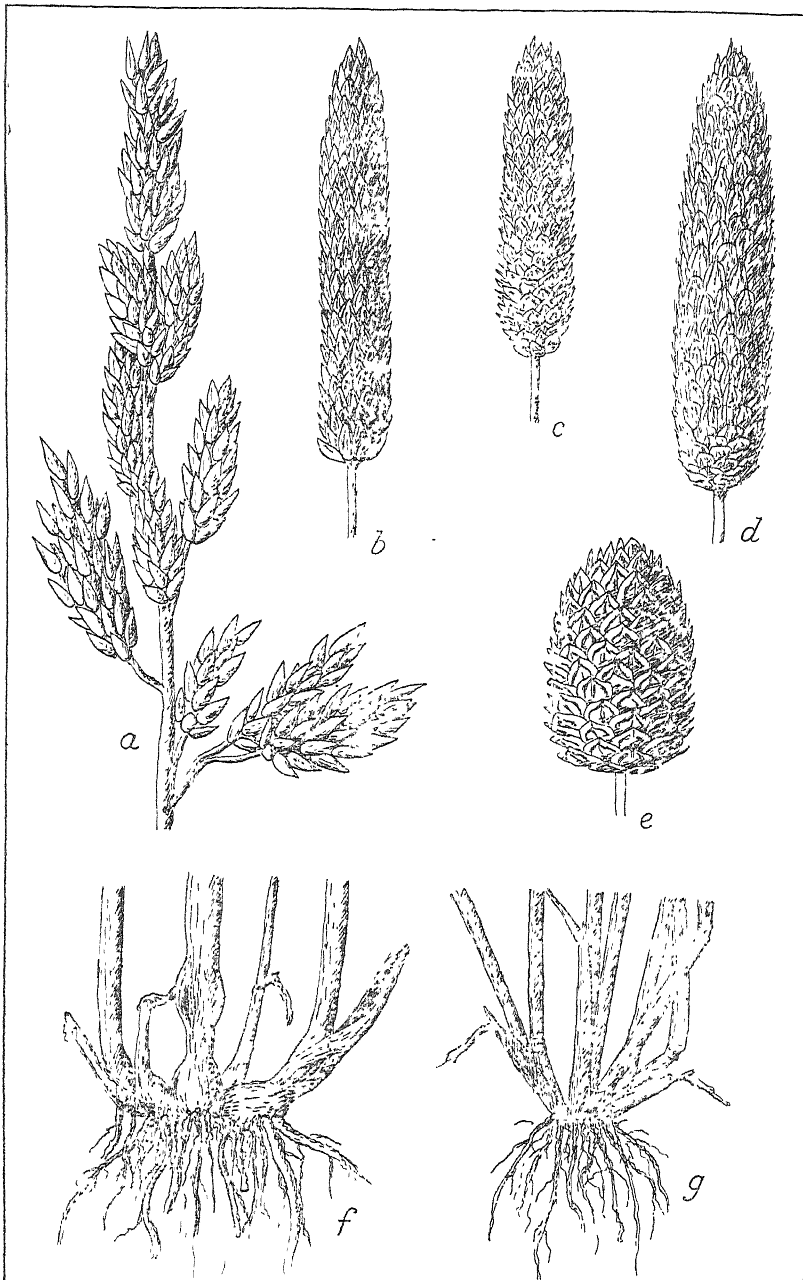


FIG. I. DISTINGUISHING FEATURES OF VARIOUS PHALARIS SPECIES.

Panicles of (*a*) *P. arundinacea*, (*b*) *P. tuberosa*, (*c*) *P. minor*, (*d*) *P. caerulescens*, (*e*) *P. canariensis*. Stem bases of (*f*) *P. tuberosa*, (*g*) *P. minor*.

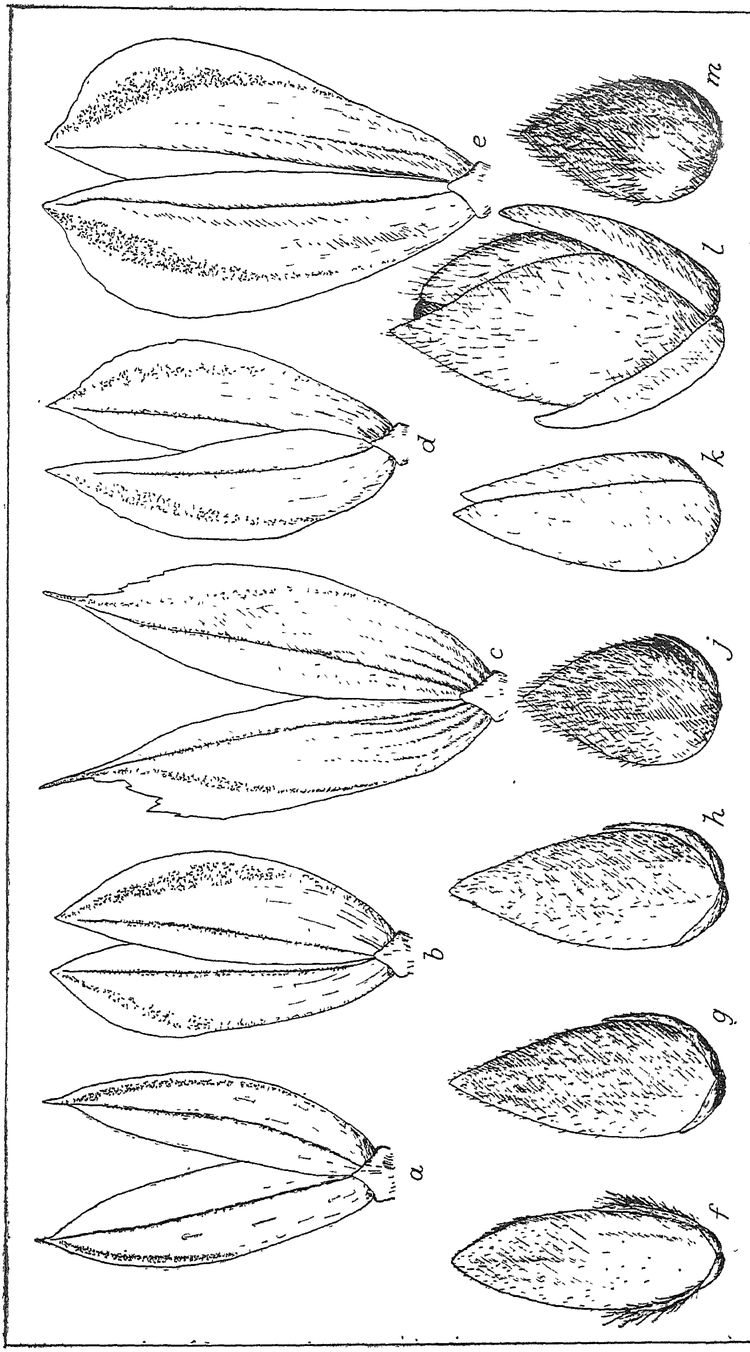


FIG. 2. OTHER DISTINGUISHING FEATURES OF PHALARIS.

Glumes of (*a*) *P. arundinacea*, (*b*) *P. tuberosa*, (*c*) *P. caerulescens*, (*d*) *P. minor*, (*e*) *P. canariensis*. "Seeds" of (*f*) *P. arundinacea*, (*g*) *P. tuberosa* (Kennedy's seed), (*h*) *P. tuberosa* (Craw's seed), (*j*) *P. minor* (light seed), (*k*) *P. caerulescens*, (*l*) *P. canariensis*, (*m*) *P. minor* (dark seed).

Each glume is sharply folded in half, thus producing a "keel" at the midrib. This keel is more or less (strikingly so in *P. canariensis*) produced into a thin winglike expansion (Fig 2, *e*). In *P. canariensis* the sterile florets are well developed, extending half the length of the fertile floret (Fig. 2, *l*); in *P. tuberosa* they are much less developed, and the first may be quite rudimentary (Fig. 2, *g*); in *P. minor* the first is reduced to a minute scale, and the second is about one-third the length of the fertile floret (Fig. 2, *j*, *m*).

1.	Panicle with distinctly spreading main branches . . .	*arundinacea*
	Panicle dense spikelike	2
2.	Perennials with short thickened root-stock, more or less basal swellings on stems (Fig. 1, *f*)	3
	Annuals lacking short thickened root-stock, not swollen at base of stems (Fig 1, *g*)	4
3.	Glumes acuminate; wings distinctly toothed	. . *caerulescens.*
	Glumes ovate, blunter; wings not distinctly toothed . .	. . *tuberosa.*
4.	Panicle oblong, sterile floret ⅓ length of fertile	. . *minor*
	Panicle short, broad; two distinct sterile florets . .	. . *canariensis.*

P. arundinacea L. (Reed Canary-grass). A plant of damp ground. Native to South Europe and North Africa. This species is easily recognized by the spreading panicle and the practically unwinged glumes. It was first recorded in New Zealand by T. Kirk for Wellington—"by a tributary of the Waiwetu, probably planted"—in 1878. This was the variegated variety, *picta*, known in gardens as "ribbon-grass." The typical form has been observed by the Waikato River near Mercer, and by the Manawatu River near Foxton. It is of no moment agriculturally.

P. caerulescens Desf.: A native of the Mediterranean region. This resembles *P. tuberosa* in habit, but has the glumes distinctly drawn out into acuminate tips. It does not occur wild in New Zealand, but has occasionally been grown on experimental farms. The name has sometimes been mistakenly applied to *P. tuberosa*.

P. canariensis L. (Canary-grass): A native of the Canary Islands. This is a common ingredient of "canary seed." The grass is easily recognized by the short broad heads, the broad wings to the glumes marked with green lines, the comparatively large fertile florets, with a prominent sterile pair at the base. It is one of the earliest recorded naturalized plants of New Zealand, having been listed by Forster in his "*Prodromus*" of 1786. Allan Cunningham in his "*Precursor*" of 1836 remarks of it: "Summit of hills cleared by the natives. Bay of Islands and its vicinity.—1826, A. Cunningham (Middle Island)—1773, G. Forster." Cheeseman (*Man, N.Z. Flora*, 1925, p. 1055) records it for both islands in "fields and waste places, abundant." We, however, have only occasionally come across it in waste places, and consider it by no means abundant as a naturalized plant. Probably the next species has often been confused with it. *P. canariensis* is insignificant as a weed in New Zealand, and is purely an annual.

P. minor Retz. (Lesser Canary-grass): A native of Europe and Western Asia. This annual species is easily distinguishable from *P. canariensis*. The heads are longer and more cylindric, the glumes are distinctly pointed and bear much narrower wings, which are more or less toothed in the upper portion. Only one sterile floret is developed, and attains to one-third of the length of the fertile floret. This has not

before been recorded as naturalized in New Zealand, having probably been passed over as *P. canariensis* It has sometimes been called *P. paradoxa*, but differs very markedly from that peculiar species, which we have not observed in New Zealand, though it is to be met with in Australia. We have noted *P. minor* in waste places in numerous localities in North Island and in the northern part of South Island. It has occasionally been grown as a crop under the misapprehension that it was Toowoomba grass, and seed has been harvested and sold as that species. The same thing has apparently occurred in Australia. The samples of recently harvested Toowoomba grass that we have seen have, however, been free from this species.

Mr N. R. Foy, Seed Analyst of this Station, separated out *Phalaris* seed from dressings of white clover into two lots—"pale" seed and "dark" seed. Both samples produced *P. minor*, the plants from the pale seed being rather more robust. Seed gathered from the plants of each lot was predominantly "dark" (Fig. 2, *m*) Ripe seed gathered from plants in waste places we have always noted to be predominantly or purely "dark," and this dark colour appears to be a good character of the strain occurring in New Zealand at any rate. Seed of *P. minor* has been noted in samples of lucerne and red-clover seed from Italian sources.

P. tuberosa L. (Toowoomba Grass, Harding Grass): A native of the Mediterranean. This is a perennial grass of valuable characteristics. It is distinguishable from *P. caerulescens*, the other perennial species bearing short rhizomes and basal swellings to the stems, by the glumes not being acuminate-pointed nor distinctly toothed The sterile floret of *P. caerulescens* are still smaller and quite glabrous, whereas in *P. tuberosa* they usually show some hairs at least. It has been grown in experimental plots in New Zealand on numerous occasions. Sown on the plots of the Earnscleugh Run in Central Otago, in 1914, by Mr. A. Macpherson, under the name *P. bulbosa*, it was still persisting and vigorous there in 1928. An area of some 50 acres was established at Linton by Mr D. Craw many years ago, and produced an excellent stand. Mr Craw has taken off numerous crops of seed of excellent quality. The plant has escaped from this area on to adjacent roadsides, and we have also noticed it as naturalized in waste places about Palmerston North.

THE "SEEDS" OF P. MINOR AND P. TUBEROSA.

As it is important to distinguish these, some further details are given. Seed taken fresh from the plants present less difficulty than dressed seed, as the dressing is apt to damage the sterile florets. Measurements were taken from samples of seed of *P. tuberosa* from Craw's area, Kennedy's Davis-grown seed, and from seed gathered from wild *P. minor* at Palmerston North. The details for the Craw sample are: Appearance, pale to rather dark brown, shining, finely striate, with five distinct nerves; fertile florets with sparse or rather dense hairy pubescence, especially on upper two-thirds; shape, rather narrow ovate-lanceolate, gradually tapering to a point; length, about 3·25 mm., breadth about 1·25 mm.; first sterile floret, minute scale with minute appendage, up to 0·75 mm. long; second sterile floret slightly larger scale, with appendage up to 1·75 mm. long, with a few hairs or practically glabrous. The Kennedy sample is the same as the

Craw one, with perhaps a slightly greater proportion of small seeds. The details for the *P. minor* sample are: Appearance dark brownish grey, shining where not covered by hairs, veins indistinct; fertile florets with denser covering of hairs, except for distinct bald patch in lower third; shape rather broadly ovate-lanceolate, rather more abruptly narrowed to a point, length about 2·75 mm., breadth about 1·25 mm.; first sterile floret reduced to minute scale without appendage; second sterile floret minute scale, with rather more hairy appendage, up to 1 mm. long.

CONCLUSIONS.

(1) Toowoomba Canary-grass and Harding grass are one and the same as *P tuberosa* L

(2) *P. stenoptera* Hack. was possibly based upon vegetative parts of *P. tuberosa* and fruits of *P. minor*.

(3) *P. minor* has at times been mistaken for *P. tuberosa*, and grown and harvested as such. It is fairly common as a naturalized plant in New Zealand, whereas *P. canariensis* is much less so.

(4) Commercial seed of *P. tuberosa* sometimes contains certain amounts of *P. minor*.

(5) It is most important both to seller and buyer that *P. tuberosa* should be provided true to name, without any significant *P. minor* content. The system of certification would ensure this.

GRADING OF CERTIFIED SEED POTATOES.

STANDARDS FOR THE CURRENT SEASON'S CROP.

J W. HADFIELD, Agronomist, Plant Research Station, Palmerston North

THE demand for certified seed potatoes is increasing very rapidly, but it is evident that the merchant and the Department of Agriculture have different conceptions as to what should constitute the main features of "certified seed."

The merchant demands varietal purity and careful grading, so that the seed may be of good appearance and readily saleable. The Department is concerned also with varietal purity, but takes into account more particularly what is termed "cropping-power," and it has left the question of grading for arrangement between the vendor and purchaser. The Department aims at the distribution of seed capable of giving satisfactory yields, and this factor is not one that can be judged from the superficial appearance of the tubers.

It is, however, evident that both points of view require consideration, and the present object is to explain the difficulties encountered in attempting to set definite grading standards, and what steps are being taken to remedy the somewhat unsatisfactory position existing at the present time.

Tags used in connection with certification have printed thereon a statement to the effect that grading is a matter left entirely between vendor and purchaser. Nevertheless, in the 1928–29 season a method was introduced by which the certifying officer could indicate on the

tag, by the use of certain figures, the grading of the seed within that sack. This method is explained later. No attempt was made to define standards for certified seed, but merely to indicate the grading of the line under inspection, so that the vendor could quote these grading figures when offering his seed; or, on the other hand, the purchaser could, in a very simple manner, stipulate a certain definite grade.

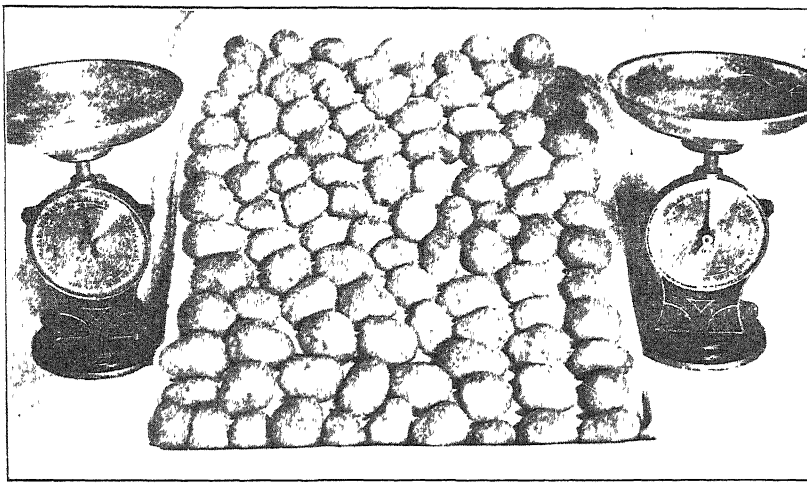


FIG I. EVENLY GRADED LINE OF SEED.

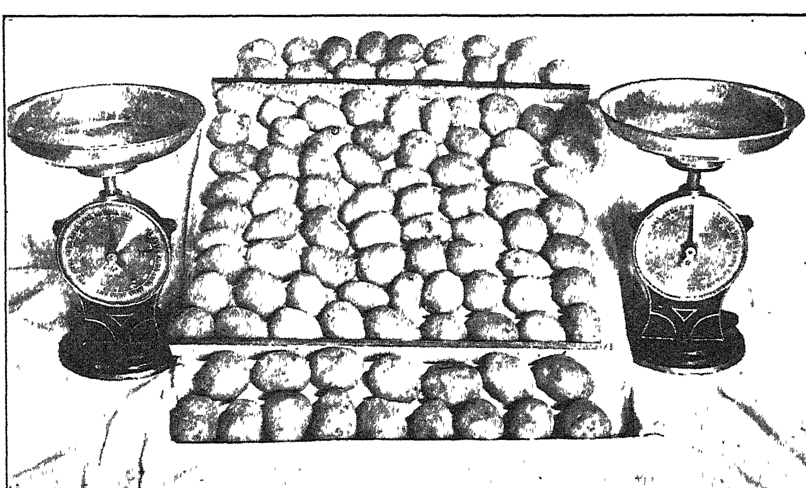


FIG. 2. SAME LINE AS IN FIG. I, SHOWING SIXTEEN LARGEST AND SIXTEEN SMALLEST TUBERS SEPARATED READY FOR WEIGHING.

Generally speaking, growers understand the significance of these figures, but as a rule the merchants have either disregarded them or not understood their import, and an attempt is made here to explain in detail the scheme as intended it should apply to the produce of the 1929–30 season.

It seems necessary to explain, in the first place, why definite standards have not been fixed for certified seed. Such a proposal met with strong opposition from merchants in Canterbury who were handling most of the certified seed. They are called upon to fill orders from all over the Dominion, and the requirements of one merchant or one district may be very different from that of another in regard to the size of seed. Some purchasers require "table" size for cutting and planting, and, since this practice is one that the Department strongly recommends, it would be a retrograde step to refuse to certify to tubers

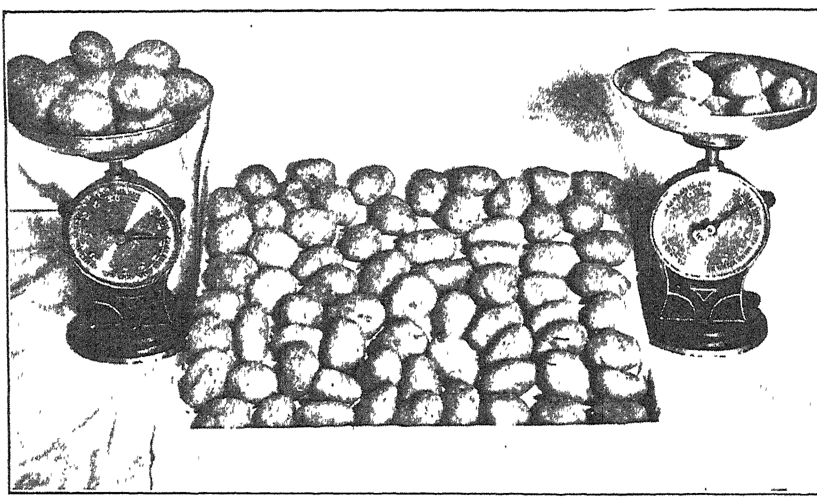


FIG. 3. SAME LINE AS IN FIGS. 1 AND 2, SHOWING WEIGHINGS.

The weight of the sixteen largest is $3\frac{1}{2}$ lb, and that of sixteen smallest 2 lb. The grading is therefore referred to as "$3\frac{1}{2}/2$."

of this size. There can be no one standard to fill all requirements, and therefore it must fall to the purchaser to stipulate the grading standard, and the method here described facilitates this to a very large degree.

One requirement is probably universal—that the tubers should be reasonably uniform in size, irrespective of whether the demand is for large, medium, or small seed. A grading standard should therefore convey in simple terms (1) the average size of the tubers, and (2) the range in size—that is, uniformity of grading. The average weight of tubers may be 3 oz. in a line ranging from 1 oz. to 8 oz., but will not be as well graded as a line having the same average weight but ranging in size from 2 oz. to 4 oz.

The use of sieves to determine size is unreliable, giving varying results according to the way they are used and the tuber-shape of the variety. Moreover, growers would have to purchase a whole range of

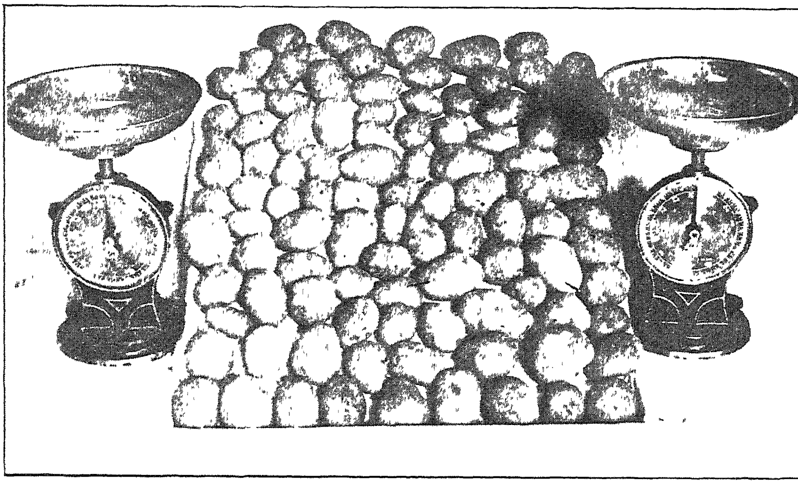


FIG. 4. BADLY GRADED LINE OF SEED.

sieves. On the other hand, probably every home has a set of moderately reliable scales, and taking tuber-weights is both accurate and convenient, and falls into line with the custom of referring to the size of tubers in terms of ounces

It has already been explained that the average weight gives no indication of the uniformity of grading, but the degree of uniformity

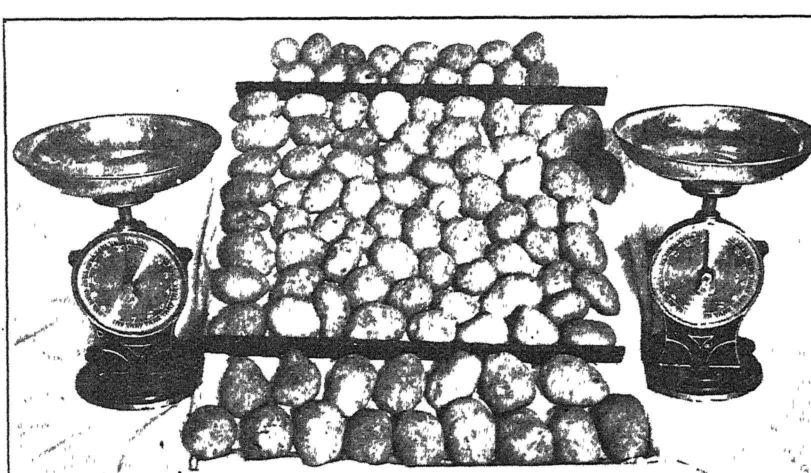


FIG. 5. SAME LINE AS IN FIG 4, SHOWING SIXTEEN LARGEST AND SIXTEEN SMALLEST TUBERS SEPARATED READY FOR WEIGHING.

may be indicated by taking at random a definite number of tubers from each sack till 100 are obtained (see Figs. 1, 2, and 3). If these are laid out on the ground they represent to the eye the average grading of the sacks sampled. To convey this grading in terms of figures the method adopted is to separate by eye measurement the sixteen largest and the sixteen smallest tubers. If these lots are weighed separately the weight will convey, after some little practice, a reasonably accurate idea of the standard of grading in that particular line. Sixteen tubers afford a convenient number, because if the weights are recorded in pounds they indicate also the average weight per tuber in ounces. Thus a line grading "6/3" means that the sixteen largest tubers weigh 6 lb. as against 3 lb. for the sixteen smallest. It also indicates that the

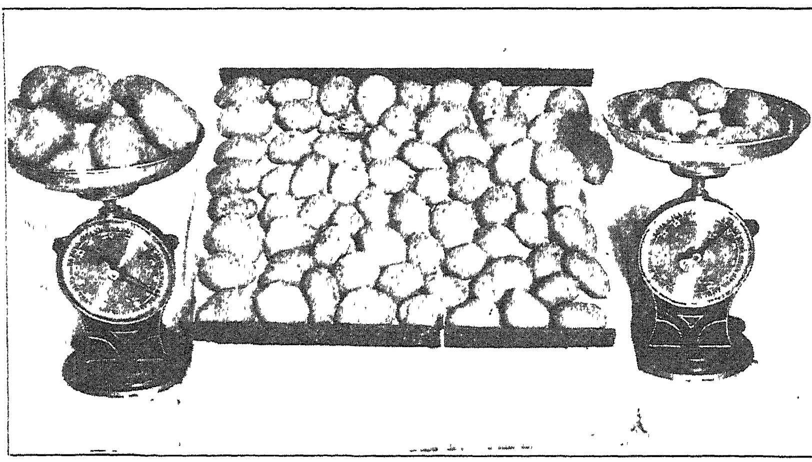


FIG 6. SAME LINE AS IN FIGS. 4 AND 5, SHOWING WEIGHINGS.

The weight of the sixteen largest is 4¾ lb., and that of the sixteen smallest 1¾ lb. The grading is therefore "4¾/1¾." There being more than 2½ lb. between the two weights, the line would be rejected for inefficient grading.

average weight of the sixteen largest tubers is 6 oz., and the average of the sixteen smallest 3 oz. The range is from round about 6 oz. to round about 3 oz. A few tubers will be over 6 oz. and a few below 3 oz These grading figures are always to be found on the tags attached to the sacks by the grower. If the merchant regrades, the figures, of course, fail to be of any value.

The final tuber-inspection for certification is undertaken when the seed is graded, in sacks, ready for sale. At least one sack in every six is opened up (with a minimum of eight sacks in any one line) and twenty-five tubers are taken at random from every sack opened. Each lot of 100 tubers is weighed for the grading standard. Each tuber is inspected, and a certain proportion cut to determine the percentage of disease present.

GRADING STANDARDS FOR THE 1929–30 CROP.

In regard to grading, the following standards will be adopted for the 1929–30 seed-crop :—

(1) If the sixteen largest tubers weigh under 2 lb. the line should be rejected.

(2) If the sixteen smallest tubers weigh under $1\frac{3}{4}$ lb. the line should be rejected, but may be regraded and again inspected at the convenience of the certifying officer (Fig 7).

(3) If the sixteen smallest tubers weigh more than $4\frac{1}{2}$ lb the grading figures should be indicated on the tag and the tag branded "Table" (Fig. 8).

(4) If the difference between the weight of the sixteen smallest tubers and the weight of the sixteen largest tubers exceeds $2\frac{1}{2}$ lb. the line should be rejected for inefficient grading, but may be regraded and inspected at the convenience of the certifying officer (Figs 4, 5, and 6).

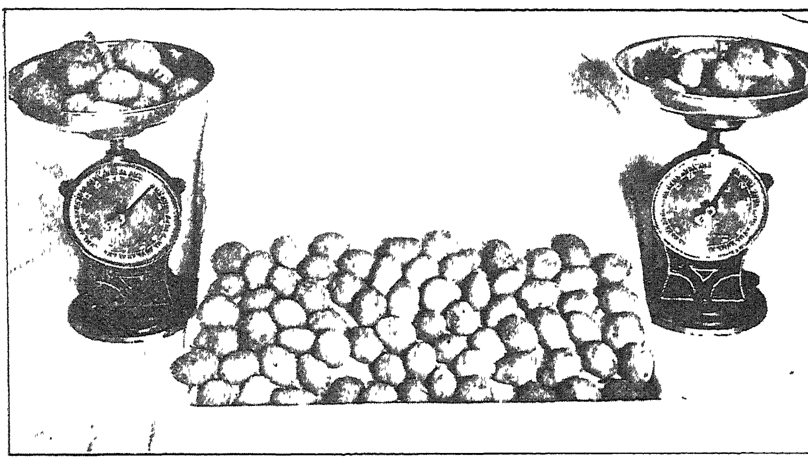


FIG. 7 LINE OF SEED WHICH GRADES "$1\frac{3}{4}/1\frac{1}{4}$."

The weight of the sixteen largest being below 2 lb., and that of the sixteen smallest below $1\frac{3}{4}$ lb., the line would be rejected on both counts Grade $2/1\frac{3}{4}$ is the smallest size which will be accepted and tagged.

PURITY AND DISEASE STANDARD.—FINAL TUBER INSPECTION.

In this connection the certifying officer will reject if there are present more than 2 per cent. of rogues (foreign varieties), 3 per cent. of late blight, 4 per cent. of powdery scab, 2 per cent. of bacterial rot, 4 per cent. of potato moth, 4 per cent. of eel-worm, or 7 per cent. of dry-rot, badly scabbed, or badly damaged tubers.

These standards are not permanent. They represent a tightening of the previous season's regulations, and it is probable that the following season will see the percentages of rogues and disease allowed in certified seed still further restricted.

ACCEPTANCE OF CROPS PLANTED WITH CERTIFIED SEED NOT A MATTER OF COURSE.

It is obvious that a farmer who plants certified seed will not necessarily have his crop accepted; in fact, it may be very much below the standard of the seed he purchased. Northern Star is the most common rogue in our white varieties, and increases so rapidly that 2 per cent. present in a certified line has been known to increase to 7 per cent in one season. If the standard of purity were 100 per cent. the position would be different, but as matters stand at present growers must at all times be prepared to rogue their crops. The presence in a crop of such factors as late blight, potato-moth, dry-rot, scab, &c,

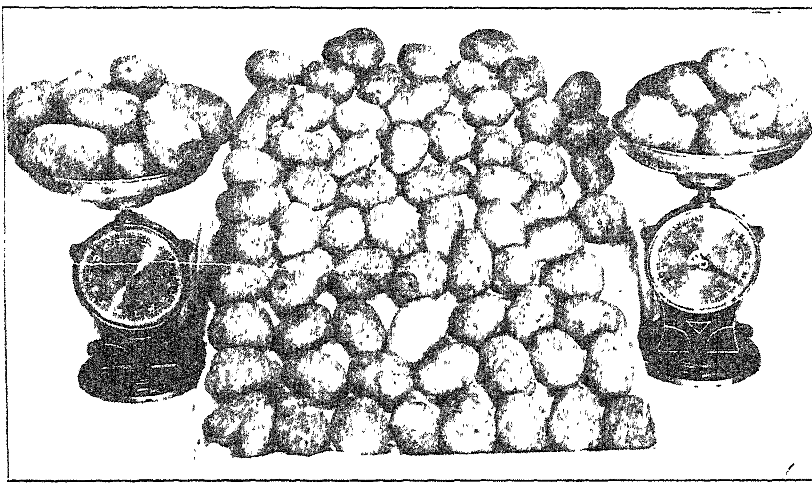


FIG. 8. LINE WHICH GRADES "7/4¾"

The sixteen smallest tubers being over 4½ lb., the tag would be branded with the word "table."

depends not so much upon the seed planted as upon climatic, soil, and management factors It would be unwise to distribute seed containing an undue proportion of tubers affected with late blight, but whether the subsequent crop is affected depends almost entirely upon the climatic conditions during the growing-period. It is obvious, therefore, that the planting of certified seed carries no guarantee that the resultant crop will be passed. The use of certified seed is a wise and reasonable precaution which will ensure that under normal conditions satisfactory yields will be obtained, provided the variety is suited to the locality.

Certificate-of-record and Official Herd-test.—During March, 1930, 846 cows. in the ownership of 267 breeders, were under C O.R. test, as compared with 649 cows and 226 breeders in the corresponding month of 1929. The O.H T. figures for March, 1930, were 1,341 cows and 128 breeders, as against 1,569 and 122 respectively for the same month last year.

COLD STORAGE OF APPLES.

INVESTIGATIONS AT NELSON, SEASONS 1927 AND 1928.

AN account of the main investigations of the Cawthron Institute into some of the difficulties associated with the cold storage of apples in the Nelson district during the 1927 and 1928 storage seasons is given in the recently published Bulletin No. 16 of the Department of Scientific and Industrial Research, by Mr. L. W. Tiller, Orchard Chemist to the Institute. The report is summarized as follows:—

(1) For securing uniformity of temperature at all points in a small experimental chamber cooled by a direct expansion dry battery situated outside the room, an air-circulation system operating from ceiling to floor has given the best results.

(2) Less internal breakdown develops in a store in which the relative humidity of the air is kept low than in a store where the humidity is high, provided the flesh-temperature is the same in both stores.

(3) Internal breakdown is more in evidence at low storage temperatures than at high, although varieties differ considerably in their power of resistance to low temperature.

(4) Internal breakdown as it occurs in the Nelson District is compared with similar physiological diseases occurring in America.

(5) Fruit grown on good soils generally shows superior storage qualities to that grown on naturally poor soils.

(6) Cultivation of the orchard and climatic factors exercise a profound influence on the keeping quality of the fruit.

(7) A well-balanced manurial programme carried out on the orchard has materially improved the storage qualities of the fruit.

(8) The root-stock upon which a variety is worked may influence the condition in which the variety turns out at the end of its storage period.

(9) Jonathan - spot is differentiated from bitter - rot, with which it is frequently confused.

(10) A limited measure of control of Jonathan-spot is afforded by the use of oiled wrapping-paper.

(11) Soil conditions and manurial treatment of the orchard cannot at present be correlated with the incidence of Jonathan-spot.

(12) Except in one instance, temperature has had no consistent effect on Jonathan-spot development. In the exceptional case there was less trouble in evidence at a storage temperature of about 38° F. than there was at 32° F.

(13) Storage humidity has had no effect on the incidence of Jonathan-spot.

(14) Delay between picking and storing usually causes a slight rise in the percentage of Jonathan-spot, but the increase is very small compared with that produced by late picking.

(15) The best control of Jonathan-spot at present available is given by picking the fruit as early as can be done without sacrificing the essentials of colour and flavour.

(16) The use of oiled wrapping-paper gives a very substantial reduction in the amount of shrivel in stored apples without detrimentally affecting them in other ways.

(17) Jonathans picked and packed as for export were put into store for three months and then kept out of store for periods up to three weeks. In no line did severe breakdown exceed 3 per cent., and fungal trouble was almost totally absent. Factors governing this experiment are similar in some respects to those obtaining in the New Zealand export trade.

SEASONAL NOTES.

THE FARM.

The Pastures.

DESPITE the fact that harrowing of pastures has greatly grown in popularity there remain many farmers who do not harrow as much as could profitably be done. Autumn harrowing of pastures proves of particular value. This can be understood when it is remembered that one of its objects is the proper distribution of animal-droppings which, if left long undistured, tend to make the pastures uneven and of coarse rank undesirable growth in patches, whereas if the droppings are properly distributed they exert a considerable valuable manurial effect This probably is recognized only in the older countries, in which the utilization of animal-manure receives so much attention. It can be grasped from the fact that careful investigation has indicated that in a year the dung produced by a herd of forty cows contains fertilizing - matter equivalent to 12 tons sulphate of ammonia, 6 tons sulphate of potash, and 3 tons superphosphate

The current cash value of this manurial material is well over £200. Efficient harrowing in the autumn results in much of this fertilizing-material being placed in the best position to serve well as nutriment for the grass crop, whereas without harrowing the material would increase the difficulty of proper pasture-utilization and also tend to bring about pasture-deterioration

The importance of the proper utilization of animal-manure requires to be kept in mind not because animal-manure may take the place being given to artificial fertilizers, but because a knowledge of the fertilizing-value of animal-manure makes clear one of the purposes and values of grassland harrowing. Reference to the great cultivation value of harrowing was made in last month's notes.

The autumn top-dressing of pastures was also dealt with in some detail last month. If dependence is to be placed on a single annual top-dressing it is highly probable that the best financial returns will be secured by applying it in the autumn. Especially should autumn top-dressing be practised if there seems any likelihood of a shortage of feed during winter and early spring. Once adequate rains have fallen such top-dressing will induce extra late autumn and early winter grass-growth.

In the autumn young pastures require careful treatment; therefore they should not be grazed too closely, neither should they be allowed to become long and productive of seed. At times it may be of assistance in bringing about strong vigorous establishment if 1 cwt. of sulphate of ammonia to the acre is applied in the autumn to young pastures, once the soil is supplied with adequate moisture to make this manure effective. If the young pastures have not recently been dressed with phosphates, then the sulphate of ammonia would be only an addition to the dressing of phosphates which usually would be required, and which generally would be of greater primary importance than the nitrogenous dressing. Sulphate of ammonia may be mixed with superphosphate, but not with basic slag or any other substance containing lime in any form.

At the time of writing dry conditions are general, and farmers may be delaying the work of top-dressing. Even if rain does not fall it is advisable to top-dress with phosphates so as to be able to secure immediate extra fresh growth as soon as the requisite soil-moisture has been supplied.

and so as not to have too much top-dressing work on hand late in the season. There is no danger of the benefits of phosphates being lost when applied under dry conditions, they will act as soon as these conditions cease. With nitrogenous manures, such as sulphate of ammonia, it is different, and farmers who are contemplating its autumn application would be well advised to delay distributing it until rains have been experienced.

Cereal-growing.

Important autumn work in connection with cereal-growing was discussed in the March *Journal* notes Matters particularly calling for attention are the control of disease and the use of manure. For the control of disease it will be found profitable to treat the seed in the ways recommended by the Plant Research Station rather than in the manner sometimes adopted. The results of extensive field experimental work show that it is generally sound practice to apply at least 1 cwt. of superphosphate with autumn-sown cereals. Hence it is a matter for congratulation that last year in Canterbury 3 acres out of every 4 acres of wheat grown received on the average a dressing of slightly more than 1 cwt. of manure to the acre.

Autumn Utilization of Crops.

The fact that dairy cows are "drying off" is neither a sound nor a wise reason for subjecting them to poor feeding The rule is that successful dairy-farmers feed the cows well during the non-production period. By doing this the cow's body and constitution are built up, thereby enabling the cow to stand the strain and the drain of several months' heavy production.

This building-up process carried out while the cow is not producing is desirable particularly with cows of heavy yield, because it is likely that such cows will utilize for production during the early part of the milking-season more nutriment than they consume, hence it is necessary that they be able to draw upon their body reserves. The cow that is well fed during her non-producing period can be expected not only to yield better after calving if she remains healthy, but also to be able more effectively to resist attacks of disease germs, and therefore more likely to remain healthy. Wide observation has established the fact that there is nothing in the belief that it is undesirable to have the cows in good condition at calving-time; and indeed that the truth lies in the contrary idea that they should be in a position to work off some of their body-weight during the early part of the season without becoming unduly lean. All this leads to the conclusion that forage reserves should be sufficient to allow of an early commencement of feeding of such materials as hay, roots, and ensilage, in case pasture-growth is inadequate to maintain the stock in good condition prior to the advent of winter conditions

The first winter is a trying and critical time with young farm stock, hence calves and hoggets should receive the best possible attention, especially in respect to feeding. With this in mind, calves should be induced to commence the eating of hay, ensilage, or other fodder strange to them before they really require it. By doing this a possible set-back at a critical stage will be obviated, in that it will be unnecessary for them to undergo a sudden more or less complete change in diet—and that at a stage when they have become somewhat poor in condition. Further, they should be supplied as long as possible with clean, short, fresh pasture.

Likewise, if it is at all possible, hoggets should be turned on to fodder crops before they have become low in condition. This should be done gradually, allowing them a run on suitable pasture, so that their digestive organs will not suddenly be called upon to function on a completely changed diet.

In the feeding of hay, ensilage, and roots, the following points are worth keeping in mind: (1) If done on the poorer parts of a field the feeding of such fodder will ordinarily tend to improve the soil of those parts; (2) if at all possible feeding out should not be done under wet conditions, as this will result in poaching of the ground; (3) hay saved at an overmature stage may contain seeds of valuable pasture-species, which if scattered and trampled in may germinate, establish themselves, and produce highly beneficial thickening of an open weak sward.

When turnips are to occupy an important place in the winter feeding of hoggets, the hoggets should be the first stock put on to each break of turnips, to be followed, after the tops have been eaten, by any sheep that are being fattened, and then by the breeding-ewes when the turnips have been grubbed to make it easier for the sheep to eat the portions which remain.

Farm Subdivision.

Efficient utilization of the farm-pastures is dependent to some extent upon the number and arrangement of the internal fences. During the next few weeks there should often be convenient times in which to make any fencing alterations or additions which will tend to give better grazing-management. Such work deserves very careful forethought. One important aspect—that of the water-supply for stock—may advantageously be given immediate consideration on many farms; the prolonged spell of dry weather experienced generally this autumn will have resulted in the stopping of the flow from all but the most reliable sources of water. Those places from which a supply of good water is still obtainable should be carefully noted, so that they can be taken into consideration when any subdivisional work is being done.

—*R. P. Connell, M.A., Fields Division, Palmerston North.*

The Clipping of Horses.

It is now seasonal to consider the question of clipping horses, and the object and advantages to be obtained by carrying out this practice. Nature has provided an extra-heavy coat for the colder months of the year in the case of animals which live under natural conditions. Rabbits' pelts give a good example of such a provision The domestic poultry moult, and a new growth of feathers is provided before the winter months. Horses and cattle wintered out-of-doors retain the old season's coat right through the winter as a protection against climatic conditions, even though the new coat is growing underneath It is only in the spring and early summer that normally this coat is lost.

In the case of domestic animals being utilized for man's convenience the question of removing the old coat by clipping is one of seasonal and district importance. The horse is man's beast of burden, and to obtain the best results in work the farmer must use all care in the feeding and general welfare of the animal. In spite of the advent of motor-power on the farm, horse teams are still much in evidence, especially in the South Island, and the working-life of the team and the results obtained will be increased considerably by the care bestowed in the management of the animals. In the North Island, where teams are not often used to the same extent, and where horses are required for more spasmodic work, the question of clipping does not merit the same consideration. An animal only required for hacking purposes or doing a trip to the dairy-factory once or twice a day is not greatly inconvenienced by an excessive coat, especially as in between times it is not housed but allowed to graze.

To obtain the best results from a working team which is having constant employment, clipping and daily grooming are most important, in addition

to a generous diet. Grooming, by providing a daily stimulation of the skin and a healthy coat, cannot be effectively carried out with heavy horses unless the winter coat is removed It has been noticed repeatedly that horses improve in condition as a result of clipping and thorough daily grooming. If the coat is not clipped horses in heavy draught work sweat profusely at this season of the year, and this is often followed by a troublesome cough. The hair becomes matted with the sweat, dust, and scales from the skin. Such a condition readily leads to shoulder or saddle galls, either of which may upset the working ability of the team. In the case of racehorses getting fast work, the animals are sponged down immediately and the saddle removed, and it is well known that the amount of time spent on grooming these animals is not limited; the coat is never allowed to become excessively long unless the animals are being spelled.

The question arises as to what area of the body should be clipped. Each farmer requires to consider whether his team can be kept fairly constantly employed If it can be so employed it is advisable to clip the body but leave the limbs. The long feather on the limbs is a protective covering, and from a health point of view it is not advisable to interfere with this. In cases where horses are not doing much carting the shoulders may be clipped, the line tapering back to the flank, or what is commonly spoken of as "trace-high." The shoulders should always be clipped as a preventive of shoulder-galls.

There are many points in favour of clipping, and very little can be said against the practice. Clipped animals are capable of more sustained work, and grooming with all its beneficial results can be more effectively carried out. Horses running outside in winter are usually protected by a waterproof rug, which is sufficient covering against rain or wind if the legs are not interfered with. An extra warm lining may be inserted under the waterproof in the region of the kidneys. If horses are clipped before the cold nights and frosts become prevalent no bad after effects should be experienced. It may be said in conclusion that, next to feeding, clipping and grooming are the two most essential requirements in good horse-management. —*J. E. McIlwaine, M.R.C.V.S., Live-stock Division.*

THE ORCHARD.

System in Picking.

PICKING and packing for storage or export will still be the main activity in orchards during the coming month. The overlapping of ripening in some of the main late varieties calls for constant vigilance, so as to arrange the sequence of picking that an even degree of maturity is maintained throughout the crop. The possibility of bad weather delaying operations must be borne in mind, for the injury to trees which have been lightly picked over is likely to be less severe than in the case of fully laden ones. The grower's anxiety decreases coincidently with the reduction of the weight on the trees, and it is then possible to regard with complacency a fairly heavy gale, knowing that the unavoidable losses will be reduced to a minimum. By commencing to pick as soon as there is a sufficient quantity of fruit with the requisite degree of maturity, and making periodical pickings as the remainder develops, the undersized and backward fruit is given an opportunity previously denied it, when it will often produce the finest-flavoured fruit in the crop. For this reason many growers leave a portion of the last picking of Sturmers on the trees to fully mature for their household requirements.

Securing Injured Trees.

Any split trunks or limbs should be braced into position and securely fastened without delay. If left until the winter the bark will have hardened in the contracted position, and interference will cause further injury. With large limbs it may be advantageous to use a wire strainer to draw the portions into close contact before securing with a bolt or wire brace, or both Close contact is essential to the future welfare of the tree, for exposed injured surfaces to which rain and air have access are liable to internal decay, which may ultimately destroy the tree. After the injured member has been firmly secured in position the wound should be painted with tar or grafting-wax, and any crevices plugged to aid in the formation of new bark and to reduce the hibernating-places of codlin-moth and other insects. For bracing limbs heavy plain fencing-wire will be found the most satisfactory. A hole of the same diameter as the wire is bored through the limb to be braced and the one to take the strain , the wire is threaded through, and the ends bent downwards at right angles to hold the limb, obviating the danger of ring-barking, which may occur if the wire is bent round the limb.

Peach-stones should be sown immediately to provide stocks for next summer's budding The stones should be sown thickly, and covered lightly with soil. Early next spring they will start into growth, and when about 2 in. or 3 in. high, or large enough to handle, they should be dibbled into nursery rows, and will be ready for budding the following February or March. Any budding this season should be completed as early as possible. The sap-flow will be decreasing with the cooler weather, and the bark will not lift readily enough to ensure success if the operation is delayed too long.

Miscellaneous Work.

Orchard props should be collected as soon as they can be dispensed with. Each season often seems to find the previous season's props a diminished quantity, entailing further expense in replacements, which could in part be avoided by early collecting and storing in a dry place.

The planting of shelter-belts can be proceeded with as soon as there is sufficient moisture in the ground A thorough preparation of the site and periodic hoeing until the trees are well established will hasten the production of satisfactory shelter. The kind of tree planted must be governed by requirements and the physical features of the site, but consideration must be given to the probable spread of the limbs and roots, and the detrimental effect on adjacent trees.

The time may be opportune for a clean-up in stone-fruit of fungi such as brown-rot, rust leaf-curl, &c., by the use of bordeaux, 6–4–40. This in conjunction with ploughing and the destruction of mummified fruit will reduce the source of infection for next season's crop. If scale has been troublesome it will be advisable to use lime-sulphur, 1–15, before leaf-fall.

Citrus-culture.

Preparation of the land for winter should be pushed on as circumstances permit. Owing to the surface-rooting habit of citrus-trees it is not advisable to plough deeply until there is sufficient moisture in the surface soil to preclude the possibility of the trees receiving a set-back.

Land for planting should be ploughed and subsoiled as early as possible, and reduced to planting-condition in frost-free localities where planting can be done in the autumn. Anything approaching a waterlogged condition is fatal to successful citrus-growing, and where natural drainage is lacking ample provision must be made for the rapid removal of surplus water by artificial drainage. The sites for the rows will need special attention, filling any depressions, a slightly ridged condition being preferable

to a uniformly flat surface. If spring planting is intended the rows should be left as rough and open as possible for sweetening, and the intervening spaces sown in cover-crop for feeding off or ploughing in. A dressing of lime should follow the ploughing.

The present is a good time to do any light pruning The crop will be sufficiently advanced for the unproductive, worn-out wood to be located, and this, together with any crowded growths or soft water-shoots, should be removed, with the object of so shaping the tree that the inside fruit can develop normally and picking be done with the minimum of discomfort In anticipation of wet weather and brown-rot attack the lower foliage should be trimmed to a height of about 18 in. from the ground, followed by a 4–4–40 bordeaux spray. Manuring at this period with nitrogenous fertilizers is inadvisable, owing to the liability of stimulating soft growth which would be highly susceptible to frost injury.

Picking should be done regularly and often. Tree-ripened fruit has the lowest commercial value, poor keeping qualities, and from the retailer's and consumer's viewpoints is generally unsatisfactory The popular demand is for cured fruit which can be relied upon for its keeping-qualities, and the marketing of fresh-picked fruit is undoubtedly the principal factor governing the sustained demand for imported lemons. "Tree-ripes" and "oversizes" in a well-regulated orchard may be regarded as an accidental product fit only for factory use Picking at intervals of two or three weeks as the fruit attains the desired size, and storing it until sufficiently coloured, eliminates the bulk of the culls and provides the desired article.

—*G. H. McIndoe, Orchard Instructor, Gisborne.*

POULTRY KEEPING.

Seasonal Management.

IF poultry-keeping is to be made a successful undertaking it is of the first importance that a sound system of management be resorted to at all periods throughout the year. In other words, doing the right thing at the right time is the keynote to success. The month of May is usually regarded as the leanest period in the poultry-keeper's year, but for the man who has worked on sound lines by the culling out of all unprofitable stock, and who has only the best of the hens which have terminated their first laying-season, no surplus male birds, and a flock of pullets bred and managed to lay in winter, the forthcoming month should show a good return over cost of production. On the other hand, for the poultryman who has neglected to cull his inferior hens and pullets, or if his pullets through being improperly cared for have gone into a false moult, failing to produce, next month will probably show a loss instead of a gain.

Although May can generally be regarded as a slack period of the year, there are several matters, apart from the ordinary routine work, which require attention if the plant is to be maintained at a high standard of efficiency. In the first place, special attention should be directed to the feeding of the prospective breeding-hens. They should be well fed but not overfed Every effort should be made to prevent the birds becoming in an overfat condition during the moulting-period or just before being called upon to produce eggs for reproduction purposes, as eggs containing strong germs, and chickens that are easy to rear, cannot be produced from an overfat hen. The birds should be frequently handled, and if there is a tendency for them to put on surplus fat the ration should be slightly reduced. They should also be encouraged to exercise as much as possible as a means

of preventing the storing-up of bodily fat. In the case of a laying flock I believe in feeding the birds well from first to last, but it is wise at times to depart from this rule where the breeding-hen is concerned.

The prospective breeding-cockerels also require special food and attention in order that they may be in the best possible nick at mating-time. The young birds should be prevented at all costs from going weak in the legs. This trouble is usually the result of an oversupply of forcing-food or a lack of exercising-space. It should be remembered that once a bird becomes badly affected with this trouble it is next to useless trying to doctor it. Prevention is the one and only safe course in dealing with this trouble; the only reliable method is to eliminate rich food such as meat, milk, &c., from the ration, and to allow ample opportunity for exercise. The ideal condition for the breeding-cockerel is a free range, as in this way a bird is given every opportunity of building up constitutional vigour, which is essential if desirable progeny are to be produced.

Secure Stud Male Birds early.

A common mistake made by many poultry-keepers who contemplate purchasing stud male birds is to leave the securing of these till too late, thereby running the risk of having to be content with the culls of the stud breeder. The most successful breeders naturally retain the best of their cockerels for their own use, the first buyer secures the pick of the remainder and so this process goes on until the last-comers have to take those that have been practically discarded. The wise poultry-keeper buys his sires well ahead, and is thus in a position to feed and manage them in such a manner that they will be in the best possible condition at mating-time. The sire is more than half the flock, and if he is to have the desired prepotency—the power to transmit his inherent quality to his offspring—he must be in the best condition possible, not overfat but full of life and vigour.

If a stud breeder has to keep cockerels for a year, or nearly so, he cannot sell these at a moderate rate and show any decent margin of profit. The cockerels have to be fed and attended to for the whole of that period, as well as taking up housing and runs at the same time. Further, how many cockerels come through a year and develop into birds which would do credit to a plant? A large proportion have to be potted by reason of natural defects developed with age, or by accidents, which will always occur, especially with pugnacious birds, as once a flock of vigorous cockerels commence fighting there is no telling what damage they will do to each other from a breeding standpoint. In short, the birds which finish their first year's existence and are fit to send out represent only a small proportion of the cockerels raised. These birds when sold should return sufficient money to more than cover the whole cost of rearing the cockerels reserved for sale. Another drawback to the policy of waiting till the last moment to purchase a stud cockerel is that it is next to impossible to buy anything at all good in the spring.

This brings to mind an inquiry recently received from a person who desired to purchase two White Leghorn cockerels from the Department's Wallaceville Poultry Station. He intimated that he would pay the price as stated in the official price-list, but did not want to take delivery of the birds until the end of August. This was asking too much, particularly in view of the moderate prices charged for the high-class stock sent out from Wallaceville.

At the present time there are a good number of well-matured high-class cockerels and White Indian Runner drakes at Wallaceville available for disposal at moderate prices, but unless orders are received for these in the near future they will be potted, as it is obviously unprofitable to

keep them longer even if all could be sold later on In the advertising section of this issue will be found the conditions and prices at which birds for breeding purposes may be secured from Wallaceville.

Standard Grade Eggs.

The question of selling eggs according to their weight and internal quality is receiving more attention than ever before in many parts of the world, including England and Canada, and New Zealand is at last awakening to the necessity for this move. Should this much-needed reform be carried into effect it is safe to assume that nothing less than a 2 oz product will be regarded as first-standard grade. Under the present system of marketing—at any rate so far as Wellington is concerned—the man with a small-egg strain of birds is in a happy position, as he receives a similar price for his 1¾ oz. eggs as the man with a 2-oz.-producing strain. Obviously the consumer pays on this basis relatively too much for small eggs and not enough for large ones.

The worst feature of this system lies in the fact that there is no inducement for the producer to breed for large eggs I have in mind a flock of Black Minorcas which, apart from the early-laying stage of the pullets, can generally be depended upon to produce eggs weighing from 2 oz. to 2¼ oz While the great merit of many strains of the domestic fowl we possess is undeniable, there is a tendency for the average flock to become smaller and smaller individually each year, consequently the eggs laid are also smaller. Although the present system of marketing gives little or no encouragement to breeders to work up a large-egg strain, it is satisfactory to know that there are still in the Dominion strains which retain the needed size, stamina, and power to produce good numbers of first-grade eggs. The warning, however, is at hand that the consuming public will not long continue to pay top prices for eggs which rattle in the egg-cup.

Poultry-keepers possessing a small-egg strain would be well advised to mend their methods of breeding and management, so that at least the great majority of the flock will produce 2 oz. eggs or over—the size so much desired not only on the local market but overseas as well. Just as the number of eggs can be increased by careful breeding and selection, so can the size be increased by the same process The tendency to small eggs will never be counteracted while yield in numbers is regarded as the one and only essential in a breeding-bird. A hen, however good a layer, should not be put in a breeding-pen if it lays a small egg. The birds laying the best eggs should be chosen—provided, of course, that their laying-capacity is satisfactory and that they possess points indicating a strong constitution.

As a means of tracing birds which lay good-sized eggs the use of trap-nests or single pens is necessary. It is true that the man with a trained eye for form can generally distinguish between the good and bad layer towards the end of their first productive season, but it is impossible to judge from the appearance of a bird at any period of its life the size of egg likely to be produced. It must be admitted that individual hens will sometimes lay eggs of varied size according to the season of the year, &c., but as a rule a normal product may be looked for a few weeks before the termination of the first laying-season. One of the secrets in maintaining a large-egg-laying strain lies in knowing that the male bird is the son of a mother that produces an egg of a desired size. Obviously this cannot well be ascertained unless the use of trap-nests or single pens is resorted to.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Uniting Colonies.

THE presence of weak hives in the apiary must be avoided as far as possible. During the warm autumn days these colonies rarely escape the attention of robber bees, and are easily molested. When once they are attacked the beekeeper will find it extremely difficult to save them, and eventually they will get robbed out despite his efforts. It is far the better plan to unite the bees with a stronger colony than to run the risk of unsettling them in the dormant season through the encouragement of wholesale robbing.

Efficient Hive-covers.

With the approach of the rainy season it is advisable to make a complete examination of the hive-covers in use. Altogether too little attention is paid to making the covers watertight, and neglect in this direction leads to winter losses No amount of labour should be spared in saving the bees from exposure and dampness, by so doing warding off the large annual losses that occur through neglect. There is no excuse for the beekeeper neglecting to protect his bees, and he will find in the long-run that a small expenditure on some suitable waterproof roofing-material will doubly repay him, and will be the means of saving colonies that would otherwise be lost. Bees must be kept dry. An examination made of colonies where proper protection is not provided will reveal the presence of large quantities of propolis. Usually this is collected to prevent the penetration of external moisture, and it is noticeable that it is gathered freely in the autumn months. Where adequate protection is provided the bees are to a large extent saved the labour of collecting the propolis, and by providing dry roofs the beekeeper is assisting them

In the case of roofs that are cracked no attempt should be made to tinker with them, but covering entirely done with some waterproof material. In the long-run metal coverings are the cheapest and the best. Good zinc or galvanized iron makes ideal covering, and will last for many years. However, quite a number of beekeepers are now using "ruberoid" or similar materials with very good results. While not so durable as metal, they serve the purpose admirably, and with careful treatment will last for a number of seasons.

Handling of Spare Supers.

Where extracted combs have been placed on the hives for the bees to clean up, these should now be removed and the bees confined to as small a space as possible consistent with the size of the colony. It may be necessary to leave some of the supers on during the winter months, and these can be dealt with in the spring. Do not leave the bees more space than they require, as it will be found that they will desert the lower supers and cluster at the top for warmth

Provision of Hive Mats.

It should be seen that each colony is provided with one or two good mats during the winter months, so as to keep the bees as warm as possible. Mats should be cut to fit exactly on top of the frames, and may be made from clean sacking or canvas. Sugar-bags or corn-sacks make excellent mats, and are easily procured. Wood mats are adopted by some beekeepers, and, if desired, may be secured at a moderate cost from dealers in bee material. In districts where the bees do not bring in a great deal of propolis wood mats are effectual. On no account use calico mats, as these afford practically no warmth.

Winter Setting of Hives.

The hives should be kept clear of all weeds, so that the flying bees may have free access to the entrances. Many bees are lost by striking growing obstacles on returning to the hives. For the next few months, when the air is more or less charged with moisture, it is important that plenty of air and as much sunlight as possible should penetrate beneath the bottom-boards In damp situations place the hives sufficiently high from the ground to avoid the dampness. Old bricks or concrete blocks make admirable supports for the bottom-boards. Make sure that the hives have sufficient cant towards the front before the winter rains set in. The presence of much moisture on the bottom-boards will be the means of much loss to the beekeeper, and, in addition, cause the hives to become sour and foul-smelling.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Small-fruit Culture.

THE month of May is the commencement of the short planting-season, when hard-wooded plants may be safely removed, and of the three to four months when this may be done it is the best. There are great advantages in having plans completed and land prepared ready to commence planting with the opening of the planting-season. Root-growth is very active during the winter, and plants set out now are well prepared, when spring arrives, to make the best possible growth during the first season.

Take delivery of your orders as soon as the plants are ready for lifting, and, if it is inconvenient to plant at once, or if the ground and weather are too moist, heel the plants in thinly in a spare piece of friable soil and they will be quite safe there until planting may be started. Before doing this, examine the plants carefully to see they are sound and vigorous, discarding any that are not true to type or up to grade The first loss is the least, and much better is it to discard poor plants now than to give them land and attention when experience has definitely proved that such are unprofitable. Attention to this one point alone will improve most plantings by 25 per cent., not that the biggest plants are always the best, especially when the root-growth is poor. A good root-system is of first importance, and next to that it should be seen that the tops are fairly well furnished with well-ripened growth of moderate length.

If such plants are set out now when the soil is friable and free from the least tendency to be sticky, a good start is obtained, and "the start is all." Plant slightly deep, and carefully firm the ground well about the roots with the heel of the boot.

Most plants of this class thrive best in a moist soil, but the least tendency to *stagnant* moisture is detrimental. If there is any tendency for flood-water to lie for a time on the surface, or anywhere within reach of the rooting-area at any level, a drainage system must be arranged to run the water off.

The Market-garden.

Where grassland is to be broken in for this class of cropping it is necessary to start early and give the soil time to mature. Under ordinary conditions the hedges should be trimmed well back, and the land skim ploughed now. When the turf is dead, cross plough the land deeply, turning the turf well under. At the same time the land may be subsoiled, or that operation may be deferred for another season. Let the land then

lie rough until near planting-time, when it should be broken down sufficiently fine for the purpose. Where planting is not done until the middle or late spring the land should be harrowed and cultivated to destroy seedling weeds as often as may be necessary. As a few bad weeds are still probably present at this stage it is usually advisable for the first season to plant crops, such as peas and potatoes, that will resist their encroachment, as well as permit thorough cultivation and cleaning of the ground.

If these paddocks are of 2 to 5 acres in extent, with good hedges, rather high, one has ideal conditions for cropping. If sufficient shelter is not established it should be completed with the greatest consideration and care. It may not be a marketable crop in the ordinary way, but it is a farm improvement of the most valuable kind, and probably costing least in cash expenditure. Its value will chiefly lie in its being well selected, placed, and trained. This will cost some thought, which is something with which one is inclined to be parsimonious. On good land of this class *Cupressus Lawsoniana*, planted 2 ft. to 3 ft. apart, makes a good evergreen shelter-belt on the side of the prevailing wind, or *Cupressus torulosa* or *sempervirens* may be used. Of the latter, seedlings with rather a spreading habit should be chosen. These cypresses will grow naturally to a height of 15 ft. to 20 ft., and be well furnished with breast wood of moderate length, thus requiring little trimming and no topping.

Secondary shelter-belts are best formed with barberry, holly, or privet, planted alternatively with Lombardy poplar. This provides excellent shelter with little labour. On the lee and sunny side the ordinary hedge is usually sufficient. The amount of shelter of this kind that may be required will depend upon locality, but more usually it is deficient. It is only excessive where plantations of large pine-trees and gums rob and shade the land, or where in a humid climate the few crops which like an open situation are closely enclosed.

New shelter-belts and hedges of this kind require clean cultivation for a few years—that is, until they are well established. Of those mentioned above only the barberry, holly, and privet will require cutting down annually to thicken the base of the plants. The others will furnish naturally in a suitable manner; moderate side-trimming alone may be required. Here again, plant no culls, but well-furnished plants of even size.

A sowing of early peas and planting of cabbage and cauliflowers for spring cutting are often started now. Warm, well-drained land should be chosen for these crops.

The Home Garden.

Lawns sown early in March will now have had their first mowing, and with their verges trimmed will have quite a smart appearance. If the shrubbery borders have been trenched or subsoiled, manured, and cleaned they will now be ready for planting. In making a selection for the purpose the first consideration is the main features of the garden, composed generally of perennial shrubs of special interest, such as rhododendrons, heaths, roses, or native flowering-plants. Between the species and different hybrids of any of the kinds mentioned there is ample material from which one could plant half a dozen gardens that would be quite distinct.

The next consideration is a suitable setting of shade and shelter trees. These may be numerous and large, or few and of naturally moderate dimensions, to harmonize with the size of home and the extent of the garden. Native Sophoras and Pittosporums, and the Japanese conifers known as Retinosporas, have a very handsome appearance when grown naturally, and their moderate height specially suits them for the smaller

garden. To say this selection and arrangement for garden planting is the highest form of art may be disputed, but it is certainly a very fascinating subject, with wonderful and varied possibilities.

Take delivery of the plants as soon as they are available from the nursery, heel them in in a piece of clean, friable ground, and water them if necessary. Plant them out firmly when the land is sufficiently dry to be free from any stickiness. Any open spaces that may remain should be planted with evergreen and deciduous shrubs for more or less temporary purposes. They will be chiefly required in the background, where they provide useful shelter, &c., that not only looks well, but it so beneficial and really necessary for the well-being of the more important plants in the foreground. As a guide to spacing it may be stated that 3 ft. between the smaller shrubs and 6 ft. between larger subjects may be generally allowed

The herbaceous border and the rock-garden are interesting excursions in gardening, but they are best when severely restricted, so that they may have sufficient time and attention devoted to them. They are then admirable features

—*W. C. Hyde, Horticulturist, Wellington.*

HYDATID TABLETS FOR DOGS.

In an article, "Prevention of Hydatid Disease in Man and Animals," published in the *Journal* for October last, and since reprinted as Bulletin No 147, reference is made to arecoline bromide as a good agent for expelling the hydatid tapeworms from the intestines of dogs which have eaten infected offal. Hitherto there has been some difficulty in obtaining supplies of the arecoline bromide, but Messrs. Kempthorne, Prosser, and Co's New Zealand Drug Co, Ltd, are now placing this drug on the market in tabloid form, in bottles containing twenty doses, at a cost of 6s. 6d. One treatment with arecoline should be sufficient, but dosing again two weeks later is recommended in order to expel any further tapeworms which had entered about the time of first dosing and had not been acted upon. After a dog is dosed with the vermifuge medicine it should be chained up for two days, and its fæces burnt in a fire, preferably lit on the contaminated ground.

INTERNATIONAL VETERINARY CONGRESS, 1930.

The eleventh International Veterinary Congress will be held in London from 4th to 9th August next A permanent committee, with headquarters at The Hague, forms a connecting-link between successive congresses and decides the programmes of meetings. Eminent veterinarians chosen from the principal countries of the world serve on this committee A preliminary programme received includes the following particulars of the agenda :—General meetings : (1) Foot-and-mouth Disease ; (2) Tuberculosis ; (3) Infectious Abortion of Cattle, Sheep, and Swine ; (4) Relationship of the Veterinary Surgeon to Animal Husbandry, (5) Veterinary Science in Relation to Public Health, with Special Reference to Production and Distribution of Meat and Milk ; (6) Law governing the Practice of Veterinary Medicine and Surgery. Sectional meetings : Section 1, Pathology, Bacteriology, and Epizooliology—(*a*) Variola in Animals ; (*b*) Anthrax ; (*c*) Swine-fever ; (*d*) Rabies ; (*e*) Distemper ; (*f*) Blackleg, (*g*) Standardization of Biological Products Section 2, Veterinary Medicine, Surgery, and Obstetrics—(*a*) Use of Drugs in the Treatment of Diseases caused by Nematode and Trematode Worms ; (*b*) Milk-fever ; (*c*) Bovine Sterility, (*d*) Acute Infectious Mastitis ; (*e*) Diseases of the New-born. Section 3, Tropical Diseases—(*a*) Theileriases ; (*b*) Control of Trypanosomiases ; (*c*) Rinderpest. Section 4, Poultry Diseases—(*a*) Fowlpox and Coryza ; (*b*) Fowl Typhoid and Bacillary White Diarrhœa ; (*c*) Fowl-plague ; (*d*) Treatment of Parasitic Diseases. Section 5, Zootechny and Dietetics—(*a*) Genetics ; (*b*) Deficiency Diseases ; (*c*) Scientific Feeding of Animals Various social functions and excursions also appear on the programme

TESTING OF PUREBRED DAIRY COWS.

C.O.R. CLOSING LIST FOR 1929.

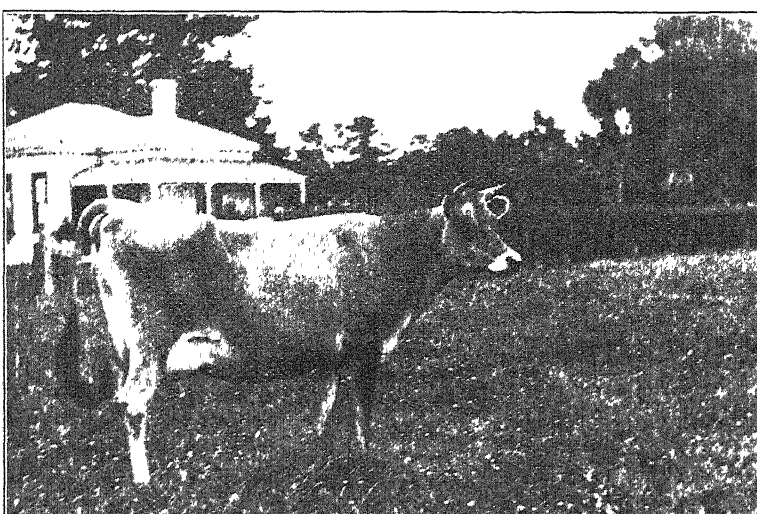
Dairy Division.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class	Tested by	Age at Start of Test	Fat req'd for Cert.	Yield for Season. Days	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old		Yrs. dys	lb		lb.	lb.
Lea Rig Pearl ..	A Christie and Co, Hikurangi	2 28	243·3	365	7,396·7	436·94
Someview Dora ..	A E Phillips, Maunu ..	2 68	247·3	365	8,507·8	436·60
Rainbow's Twylish Girl	G S Clarke, Te Awamutu..	1 357	240·5	365	7,095·0	436·06
Linden Grove Sweet Pea	G S Clarke, Te Awamutu	1 359	240·5	326	7,066·4	416·46
Someview Lady ..	A E Phillips, Maunu .	2 70	247·5	365	7,066·4	326·34
Raupo Anne ..	Boon Bros, Whakatane ..	1 317	240·5	353	4,758·0	296·22
Raupo Blossom ..	Boon Bros, Whakatane ..	1 329	240·5	301	5,065·6	294·48
Royton Ellen ..	J. Gaddes, Morrinsville ..	1 297	240·5	331	5,254·5	283·12
Butter Eyes of O K .	E. Jamieson, Paeroa ..	1 284	240·5	346	4,469·2	266·84
Cook's Perfection ..	Cook Hospital Board, Gisborne	1 341	240·5	365	4,982·2	264·72
Dainty Tulip of O K	E Jamieson, Paeroa ..	1 344	240·5	365	4,621·0	251·01
Four-year-old						
Idalia's Saucy ..	A Christie and Co, Hikurangi	4 31	316·6	365	12,062·9	695·59
St. Lambert's Superior	Boon Bros, Whakatane ..	4 306	344·1	365	9,186·1	542·13
Rosy Creek Comely ..	T. H. Western, Bell Block..	4 40	317·5	304	9,844·6	527·61
Raupo Glory ..	Boon Bros, Whakatane ..	4 335	347·0	343	9,031·9	498·63
Mature.						
Springfield Belle ..	Mrs J B. Masterton, Havelock North	7 23	350·0	365	10,773·5	645·58
Adora's Jewel ..	A Moreland and Sons, Te Rapa	9 27	350·0	341	9,111·4	441·36
Lady Gray ..	A Moreland and Sons, Te Rapa	9 47	350·0	282	7,076·1	440·79
Xenia's Juillette ..	S Dale, Fairlie . ..	5 97	350·0	257	6,377·6	403·05
	FRIESIANS.					
Junior Two-year-old						
Livingstone Snowflake	W J Eames, Hunterville	2 77	248·2	365	13,266·2	492·25
Melrose Sylvia Echo Keyes*	T Sherriff, Clandeboye ..	1 337	240·5	365	12,022·6	482·13
Senior Two-year-old.						
Melrose Model Queen Sylvia*	T Sherriff, Clandeboye ..	2 263	266·8	365	14,656·0	533·40
Junior Four-year-old						
Hobson Zozo Pontiac*	Hobson Farm, Ltd, Wharepapa	4 69	320·4	365	19,933·9	736·68
Senior Four-year-old						
Hobson Pontiac Ormsby*	Hobson Farm, Ltd, Wharepapa	4 291	342·6	304	15,997·0	533·22
Hobson May Pontiac	Hobson Farm, Ltd, Wharepapa	4 300	343·5	305	12,800·7	444·61
Mature						
Weston Lea Challenge Fancy*	E F Peacocke, Hamilton ..	9 36	350·0	354	19,022·4	529·79

LIST OF RECORDS—*continued*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat
MILKING SHORTHORNS.						
		Yrs. dys.	lb.		"	lb.
Junior Four-year-old						
Waimea Faith ..	R V Brown, Weraroa ..	4 25	316·0	300	9,731 8	367·68
Mature.						
Waimea Winsome ..	R V Brown, Weraroa ..	8 311	350·0	365	13,811·1	564·49
Waimea Lilac ..	R. V. Brown, Weraroa ..	6 302	350 0	365	12,927·1	477·06
Second-class Certificates.						
Jerseys.						
Junior Two-year-old						
Raupo Bounty	Boon Bros, Whakatane ..	1 364	240·5	347	5,435·4	296·54
Raupo May	Boon Bros, Whakatane ..	1 328	240·5	354	5,555 6	295·99



RYDAL GIPSY (T. M. REMINGTON, WESTMERE, WANGANUI).
C.O.R. in Jersey junior two-year-old class: 8,979 5 lb milk, 610·6 lb butterfat.

Average Production of Canadian and New Zealand Dairy Cows.—The latest available figures indicate that Canada's average cow produces 4,745 lb. milk containing 166 lb butterfat. New Zealand's average cow for the 1928-29 season, including all cows in milk and dry, is estimated to have produced 212 lb. butterfat. The average test in New Zealand can be taken at about 4 per cent., which represents an average milk-production of 5,300 lb.

WEATHER RECORDS: MARCH, 1930.

Dominion Meteorological Office.

General Notes.

March was an exceptionally dry month. Few places received half the average fall, and no case has yet been reported where the average was reached. North of Otago the mean deficiency was between 70 and 80 per cent., and it is only in the southern portions of Otago and in Southland that the departures from normal fall to moderate dimensions. Some places, such as Auckland, Oamaru, and Westport, had the lowest rainfall ever recorded in March, while at very many others lower totals had been recorded on two or three occasions only.

As would be expected in view of the dry conditions, there was an unusual amount of sunshine. The highest total recorded is 276·6 hours, at Nelson, but New Plymouth had 271·6, Masterton 261·6, Auckland 257·9 hours (its record for March), Napier 252·0, Hanmer 248·1, and Wellington 245·1 hours.

In spite of the fact that there was so much sunshine, temperatures were again below normal, this being the ninth in a succession of comparatively cold months. Frosts were rather numerous, and on the 27th and the 30th were severe enough to do some damage.

Owing to the heavy rains experienced in December and January, and the consequent luxuriant growth of herbage, the dry weather of March did good rather than harm. There was still an ample supply of pasture in most districts at the end of the month, and it was more fattening than at the beginning of the year. Crops of all kinds ripened well, too, and harvesting and picking operations were facilitated. At date of writing, however, rain is badly needed.

The prevailing weather during the month was of the anticyclonic type, with its characteristic clear skies and absence of wind. The anticyclones moved on an unusually far southern course, and several of them were very intense. Pressure systems in general moved rapidly and regularly from west to east. The storm systems experienced were, with one exception, of slight or moderate intensity only. Between the 6th and the 10th there were showers in most districts. These occurred mainly in the southerly winds following depressions of the westerly type which passed on the 5th and the 8th respectively. On the 23rd a depression of cyclonic form developed in the Tasman Sea and good general rains seemed imminent. But on the 24th, although the intensity of the storm had increased, its centre moved southwards across the extreme southern extremity of the Dominion. Rain was fairly widespread and there were a few heavy falls in the South Island, but a general rain was missed. The depression was preceded by strong northerly winds and followed by gales from the south west or west.

Rainfall for March, 1930, at Representative Stations.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	0·83	4	0·48	3·55
2	Russell	1·03	7	0·62	3·13
3	Whangarei	0·79	5	0·56	4·32
4	Auckland	0·24	3	0·21	3·03

RAINFALL FOR MARCH—*continued.*

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
		North Island - continued			
		Inches.		Inches.	Inches.
5	Hamilton	[illegible]	3	[illegible]	3·88
5A	Rotorua .. .	1·05	4	0·59	3·51
6	Kawhia	0·54	4	0·35	3·45
7	New Plymouth	1·11	6	0·62	3·62
8	Riversdale, Inglewood .	2·37	6	1·40	7·39
9	Whangamomona	1·03	3	0·60	5·61
10	Eltham	1·07	3	0·60	4·68
11	Tairua	0·58	3	0·44	5·92
12	Tauranga	0·85	6	0·31	4·16
13	Maraehako Station, Opotiki	0·82	6	0·36	4·00
14	Gisborne	0·37	2	0·10	4·51
15	Taupo	0·45	3	0·25	3·25
16	Napier	0·18	2	0·13	3·29
17	Maraekakaho Stn, Hastings	..	..	..	3·10
18	Taihape . . .	0·14	4	0·04	2·05
19	Masterton	0·51	5	0·33	3·15
20	Patea	1·73	6	1·10	3·62
21	Wanganui	0·63	2	0·55	2·62
22	Foxton	0·88	4	0·68	2·20
23	Wellington (Karori Reservoir)	0·46	4	0·32	3·48
		South Island.			
24	Westport	1·56	9	0·52	7·50
25	Greymouth	3·71	13	0·90	8·70
26	Hokitika ..	4·07	15	1·02	9·70
27	Ross	4·61	11	0·94	10·35
28	Arthur's Pass	..	..	..	9·74
29	Okuru	8·90	7	5·10	15·48
30	Collingwood	..	..	..	4·19
31	Nelson	0·43	2	0·42	3·08
32	Spring Creek	0·06	3	0·02	2·16
33	Tophouse	0·55	3	0·35	4·33
34	Hanmer Springs	0·64	5	0·39	2·89
35	Highfield, Waiau	1·04	4	0·42	3·00
36	Gore Bay	0·96	5	0·45	2·29
37	Christchurch	0·52	6	0·35	2·05
38	Timaru	1·00	9	0·58	2·31
39	Lambrook Station, Fairlie ..	0·28	2	0·15	2·47
40	Benmore Station, Clearburn	0·29	0	0·09	2·69
41	Oamaru	0·16	4	0·06	1·73
42	Queenstown . ..	1·33	6	0·37	2·60
43	Clyde	0·19	4	0·60	1·50
44	Dunedin .. .	0·73	9	0·25	2·98
45	Wendon	2·15	10	0·62	2·68
46	Gore	1·85	11	0·44	3·27
47	Invercargill .. .	3·42	19	0·90	3·90
48	Puysegur Point	5·63	22	0·97	8·00
49	Half-moon Bay . .	4·49	16	0·91	5·79

—*Edward Kidson, Director of Meteorological Services, Wellington, 5th April, 1930.*

Fruit-export Levy.—The rate of levy for the 1930 season is fixed by the Control Board at 1¼d. per case, a reduction of ¼d. from the 1929 figure.

EMPIRE FARMERS AT RUAKURA FARM OF INSTRUCTION, HAMILTON.

This interesting gathering took place on 26th February last, when the visiting delegations from Britain and South Africa met at Ruakura the party of Australian dairy-farmers touring the North Island. The British party occupies the centre of the group, with the Australians on left and South Africans on right (of photo).

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

DOG WITH SORE FEET

"KURI," Kohuratahi :—

I have a dog twelve months old which has had very sore and cracked feet for a few months. He has done very little work and has never been on a metalled road. The paws are quite dry and swollen. I should be grateful for information as to a cure.

The Live-stock Division :—

The condition you describe may arise from interdigital eczema or from interdigital cysts. Rest and cleanliness are important factors in bringing about recovery. The dog should be provided with a comfortable bed of straw in a clean kennel. Rest should be enforced, the dog not being allowed to pull at a chain, as young dogs are accustomed to do. The feet should be dressed daily with olive-oil, and afterwards protected with some covering. Dressing and rest should be persevered with for some weeks.

KIKUYU-GRASS FOR NORTH AUCKLAND CONDITIONS.

A. HENSLEY, Taheke, Hokianga :—

Would you please give me some information about kikuyu-grass. What kind of soil does it require? Is it liable to spread from paddock to paddock and become a nuisance? How does it compare with paspalum?

The Fields Division :—

Kikuyu-grass is a native of South Africa, and requires a warm climate and freedom from frosts to do well. The grass has an enormous root-system, and will grow on almost any class of soil provided the climate is favourable. During the early years of establishment the grass throws a large amount of feed in the late summer and early autumn, but it soon becomes sod-bound, and when in this condition produces very little feed. Kikuyu is not nearly as useful for your conditions as paspalum. The grass does not seed and must be planted out, using small pieces of the root for this purpose. Kikuyu will spread fairly readily from one paddock to another, and when planted on slips and on the higher hills, floods may carry the roots of the grass down on to the good land on the flat, and it may later become rather a nuisance in the drains and on good flat grassland.

LAME PIGS.

"P," Palmerston North :—

About six of my bacon pigs are more or less lame. I have been applying bluestone and have also tried butter of antimony. The pad of the foot (one toe only) swells, then cracks and turns septic. The pigs have been fed on skim-milk chiefly, with some green food also. They are all confined in fattening-pens with boarded floor, except one maiden sow which has been running out on grass. Advice would be appreciated.

The Live-stock Division :—

It is rather difficult to state the cause of the lameness without an examination of the premises. The infection may gain entrance through some injury to the foot. It would be advisable to thoroughly clean up and disinfect the feeding-pens, or change to a new site if possible. If the old site is retained a liberal use should be made of slaked lime to kill the infection, which would appear to originate from the soil or from the fattening-pens. Attention should be paid to drainage and sanitation. Skim-milk is not a satisfactory diet, even with green food added. Upon such a diet pigs are more liable to infection than would be the case were the diet better balanced and more liberal.

WHEAT AND OAT THRESHINGS.

TABULATED below are returns of threshings of this season's wheat and oat crops received by the Census and Statistics Office up to 19th March, covering the period January and February, 1930.—

Land District	Wheat					
	Firsts			Seconds	Total threshed.	Average Yield per Acre.
	Tuscan or Longbury.	Hunters (Varieties).	Pearl or Velvet.			
	Bushels	Bushels	Bushels.	Bushels.	Bushels	Bushels.
North Auckland ..	..	..	..	..	..	..
Auckland ..	..	..	..	..	..	..
Gisborne ..	480	..	..	..	480	30·00
Hawke's Bay ..	6,516	..	..	505	7,021	30·79
Wellington ..	7,032	690	3,775	232	11,729	43·93
Nelson	2,563	5,213	350	537	8,663	20·04
Marlborough ..	12,662	2,679	..	1,383	16,724	27·97
Canterbury ..	1,262,789	218,566	86,767	46,851	1,614,973	31·04
Otago	45,910	25,200	14,228	5,154	90,492	32·62
Southland ..	..	..	166	6	172	21·50
Totals ..	1,337,952	252,348	105,286	54,668	1,750,254	31·08

Land District	Oats.					
	White.	Dun	Black.	Algerian.	Total threshed	Average Yield per Acre.
	Bushels	Bushels.	Bushels	Bushels	Bushels	Bushels.
North Auckland ..	..	..	..	..	..	..
Auckland ..	..	..	..	.	..	..
Hawke's Bay ..	..	..	..	5,386	5,386	42·41
Wellington ..	283	..	..	3,309	3,592	36·65
Nelson	40	..	..	1,234	1,274	26·54
Marlborough ..	749	1,442	280	5,696	8,167	34·75
Canterbury ..	145,524	48,769	4,587	77,082	275,962	37·41
Otago	32,416	5,397	746	27,515	66,074	47·26
Southland ..	..	1,464	.	..	1,464	17·22
Totals ..	179,012	57,072	5,613	120,222	361,919	38·64

FORTHCOMING WINTER SHOWS.

THE following dates have been notified by show secretaries :—

Southland A. and P. Association : Invercargill, 13th to 18th May.
Whangarei A. and P Society : Whangarei, 13th to 17th May.
Waikato Winter Show Association : Hamilton, 27th May to 3rd June.
Otago A. and P. Society : Dunedin, 31st May to 5th June.
Wairarapa Winter Show Association : Masterton, 2nd to 7th June.
Taumarunui Winter Show Association . Taumarunui, 4th to 7th June.
Poverty Bay Winter Show Association : Gisborne, 11th to 14th June
Manawatu A. and P Association Palmerston North, 17th to 21st June.
South Taranaki Winter Show Company : Hawera, 25th June to 2nd July.
Te Kuiti and District Winter Show Association : Te Kuiti, 2nd to 5th July.
Wellington Winter Show Association : Wellington, 8th to 26th July.
Auckland Winter Exhibition : Auckland, 9th to 19th July.

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CONTROL OF RAGWORT AND OTHER WEEDS BY SPRAYING.

REMARKABLE RESULTS WITH SODIUM AND CALCIUM CHLORATE.

J. W. DEEM, Director, Fields Division, Department of Agriculture

FOR the last twenty years or more various sprays have been tried for the control of ragwort. Some have been a partial success, but owing to such difficulties as poisoning of stock, excessive cost of material, cost of application, and failure to actually kill a large proportion of the ragwort-plants none have been sufficiently practicable to come into general use.

During the past six months the Fields Division has been testing the merits of sodium chlorate and calcium chlorate for the control of ragwort, with very gratifying results. Where properly applied the chemicals mentioned completely destroy all the plants and stand out far above any other sprays for the control of ragwort that have come under the writer's notice. In addition to the control of ragwort they appear equally effective for pennyroyal, St. John's wort, ox-eye daisy, and many other soft-leaved weeds, while there are indications that they will be valuable in the control of Californian thistle and similar weeds. However, further work is necessary before reliable information will be available in respect to these latter plants.

POINTS OF INVESTIGATION AND TRIAL RESULTS.

A start was made to experiment with chlorates on ragwort in October, 1929. The main points of investigation were: (1) The effect of the spray on weeds; (2) the best time to apply it to secure the greatest efficiency at the least cost; (3) the most suitable strength to use; (4) the best method of application—whether as a spray or in dry form; (5) the effect on pasture.

Careful work was carried out under the several aspects, and the results may be summarized as follows:—

(1) On ragwort, pennyroyal, St. John's wort, ox-eye daisy, and similar soft weeds a 100-per-cent. kill was obtained where all plants

were properly sprayed. It may be mentioned here that only a light wetting of the plant with the spray is necessary.

(2) The best results were obtained when the plants were young, so long as there was sufficient foliage to hold the spray. For instance, ragwort was best treated when it was from 3 in. to 9 in. high Areas at this stage treated in October have shown no signs of recovery. Older ragwort right up to the flowering stage is equally well destroyed, but a great deal more time and material are required to cover the plants ; besides, where the plants are allowed to grow big a certain amount of suppression of pastures has taken place.

(3) The material was tried as a spray at strengths varying from 1 to 10 per cent —1 lb. of material to 10 gallons of water up to 10 lb. of material to 10 gallons of water. It was soon discovered that the stronger strengths were not desirable, and generally it has been found that 4 to 5 per cent gives the best all-round results. But $2\frac{1}{2}$ per cent. has given excellent results with ragwort, and even 1 per cent. has given 60 per cent. of kill on tall ragwort in full flower. Until such time as definite strengths have been further tested our advice is to use from 3 to 5 per cent., according to the age of the plants. In no case has the material at these strengths failed to give 100 per cent. kill The spray has very little effect on the plant for the first twenty-four hours, but after this it gradually changes colour, and is dead in about a week. Spraying should not be done while it is raining, but in the trials where rain came on an hour or two after spraying it did not appear to have any detrimental effect on the results.

(4) The calcium chlorate was applied as a spray, but the sodium chlorate was tested both as a spray and in the dry state. The latter method was equally effective where the crystals were applied direct to the weed, but was a great deal more costly, both as regards time taken to apply and cost of material Therefore spraying is recommended for general work.

(5) Spraying with strengths up to 5 per cent. had little detrimental effect on the grass, but stronger solutions caused considerable burning ; likewise the dry applications. It was also noted that any burning in the spring during the growing-period, and when rain was frequent, disappeared in a few days, whereas summer burning took a longer period for recovery.

General Notes.

Both sodium and calcium chlorate are safe so far as stock are concerned, and spraying may be done while the paddocks are being grazed. Mr. C. S. M. Hopkirk, Officer in Charge of the Wallaceville Veterinary Laboratory, has drawn my attention to a statement in the *Cornell Veterinarian* that sodium chlorate in fairly large doses is claimed to be a tonic for cattle. While both chlorates have done excellent work here, it is considered that the sodium has given the better results. The question as to which chlorate to use will greatly depend on cost of material and convenience of transport. The general question of costs of sodium and calcium chlorate is at present receiving attention. The material used up to the present has cost less than 3d. per pound f.o.b. London, and slightly lower quotations have now been received.

Sodium chlorate is supposed to be easily inflammable when dry on clothing. Users are therefore advised to wash any clothes that

may become saturated with this material during spraying operations before allowing them to dry. Calcium chlorate has the advantage that there is not the same danger from fire. Sodium chlorate, while quite safe to handle, forms explosive mixtures with a number of other substances—for example, strong acids, sulphur, and sugar It should therefore always be used alone (as powder or dissolved in water as instructed above) and never mixed with other substances.

From the farmer's point of view these chlorates have the great advantage that they completely kill ragwort and similar weeds; the work can be carried out without fear of poisoning stock; what is really of the greatest importance is that the weeds may be tackled as soon as they show above ground in the spring, and the work practically

RAGWORT CONTROL TRIAL AREA ON W. HOOPER'S FARM AT WAIPUKU, TARANAKI.

Foreground, and background up to fence, sprayed with sodium chlorate; centre, cut and showing second growth of ragwort.

[*Photo by H. Drake.*

completed before the busiest time of the year sets in; and when the weeds are sprayed in the young stage the cost of material is not great. It must be remembered that all ragwort does not appear at the same time, so it is necessary to go over the farm several times in the year and spray what weeds are showing at the time. At the Stratford Demonstration Farm it was necessary to go over the field three times. The main crop was treated in November, and later in January and February, when certain plants that had been missed in the first spraying were killed.

It is very difficult to arrive at the quantity of material required to spray an acre of land infested with ragwort. For instance, on the Stratford Demonstration Farm, where only scattered plants were to be found, approximately 1½ lb. of material per acre was used, whereas on

another farm, where a fairly solid block of 5 acres of ragwort standing about 3 ft. high was treated approximately 22 lb. of sodium chlorate per acre was used. Although most of the plants on this area were in bloom, the effect of the spray was such that all were killed and no seed ripened, as would have been the case had the plants been cut and allowed to lie. This is important, preventing, as it does, reinfestation by seeds.

The work carried out clearly indicates that spraying with chlorates is much faster than either cutting or pulling, and the expenditure in material is amply recovered in the lesser labour involved. In addition, the chlorates definitely kill, and therefore give promise of providing the farmer with a method whereby the elimination of ragwort may become possible.

The foregoing matter may be regarded as preliminary. More definite information and instructions will be given in a further article to be published shortly in the *Journal*.

ANTE-NATAL DEFORMITY OF LAMBS.

A PRELIMINARY INVESTIGATION IN OTAGO.

C. S. M. HOPKIRK, B.V.Sc., Officer in Charge, Wallaceville Veterinary Laboratory.

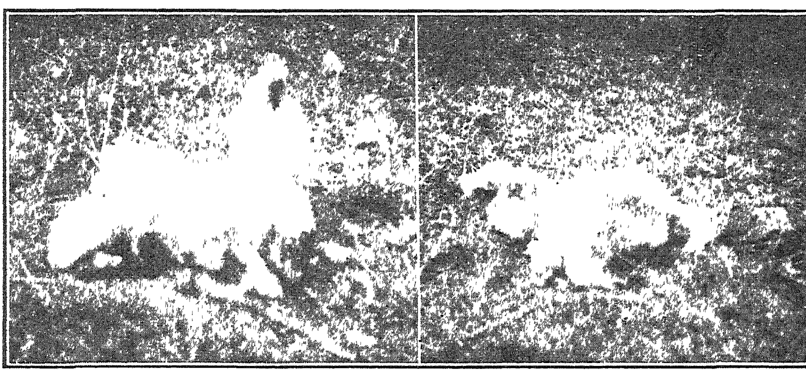
FOR several seasons farmers in parts of Otago have been reporting a serious loss at lambing-time from deformed dead fœtuses. An opportunity was recently afforded, during an investigation into mortality of lambs from so-called pulpy kidney, to obtain definite information on the subject, together with specimens and histories, from a number of the farmers concerned.

Regarding the type of monstrosity, there is only a rudimentary mandible, shown as two rounded protuberances at the base of the skull. The inferior maxilla is overshot and gives the general appearance of a seagull's head. The legs are shortened and often of different sizes, but have the correct number of bones. The spinal column is arched, and some of the cervical vertebræ are fused. The wool has grown normally, but the whole fœtus is expelled with the membrane. Many ewes have difficulty in lambing in such cases. Frequently there are twin lambs, the one deformed, the other apparently normal but very often with little stamina. Many lambs born alive in affected flocks are unable to use fore or hind limbs, and die from starvation before the third day. Where the farmer has to give help to a lambing ewe it must be done with the utmost aseptic precaution, or the ewe may die from septicæmia. Many ewes are unable to lamb at all and have to be destroyed. A post-mortem examination of such a case shows intense œdema of the uterus and uterine horns, and especially of the uterine cotyledons. There is often a large quantity of peritoneal fluid, the result of the œdema.

Microscopical sections of the organs of a ewe gave results as follows: Pituitary body: The posterior portion contained hæmorrhages which may or may not have been due to rough excision of the gland. The anterior portion appeared intensely congested. Uterine wall: Very much

thickened and œdematous The glandular epithelium was normal, but the lumen of glands contained many polymorphs and a few lymphocytes, the cells having worked through the glandular epithelium from the connective tissue No organisms nor metritis were in evidence. Cotyledons: Œdema beneath body of cotyledon and to some extent on free surface. Villi of cotyledons becoming detached Normal but for œdema. Kidney: Slight congestion of glomeruli. Very slight excess of fluid in connective tissue. Otherwise normal.

It has been observed on some of the affected farms that the lambs from the affected flock which live are inclined to be more susceptible to death from so-called pulpy kidney at from two to four weeks of age, and one such case may be given. One hundred and three half-bred ewes mainly, with a few crossbred Romneys, two-tooth to eight-tooth, were bought on 26th April, 1929, and Romney rams were used



DEFORMED LAMBS ON ONE OF THE AFFECTED FARMS.

The monstrosity on left has a seagull-shaped head. In both cases the lower jaw is missing and legs are short. Photos taken 14/10/29.

on them. In October and November seventy-five lambs were born deformed or paralysed. There were also seventeen lambs lost from pulpy kidney.

There seem to be four possible reasons for the production of deformed fœtuses: (1) A lethal factor in the Romney rams, (2) ergotism, (3) iodine deficiency, (4) faulty sheep husbandry and type of pasture.

(1) *Breeding Factor.*—Notes of cases given later will show that genetics are not likely to be a factor. The condition appears in Romney, Corriedale, or half-bred ewes, and from Romney, half-bred, Corriedale or English Leicester rams, irrespective of the part of the country from which they originated. It so happens that Corriedales, half-breds, and Romneys are the chief breeds of the district in question. In the neighbouring district where losses occur Romney only have shown the fault, but the Romneys are greatly predominant in numbers.

In one season the same rams on the same lot of ewes have produced monstrosities, while the year before or the year after on a different class of country the lambs born have been normal. Ewes which have had deformed lambs one season have had normal lambs the following season, even to the same ram. The percentage of deformities, too, is

high, and would appear to be too high for lethal factors in sheep so widely unrelated, even had they all been Romneys as was originally held.

(2) *Ergotism.*—From the fact that pastures were noticed two years ago to be usually Chewings fescue, the possibility of the continuous action of ergot on the pregnant uterus was considered to be the most plausible explanation. This season, however, cases have been found where the ewes did not have access to ergotized grasses, and this applies particularly on one farm where for three years in succession the affected sheep have been running on turnips, with a run-off on to bare tussock which contained small quantities of *Poa colensii*, hair-grass, danthonia, Yorkshire fog, catsear, and pimelia.

(3) *Iodine Deficiency.* — This was considered a possibility, based mainly on the fact that an experiment of excision of the thyroid glands which was supposed to have been performed in India resulted in a similar deformity being reproduced. Analysis of thyroids for iodine in deformed fœtuses gave results as follows :—

	Weight of Gland. Grammes.	Iodine Content Grammes	Percentage of Iodine calculated on Fresh Weight.
(1)	1 30	0·0003	0·019
(2)	7·08	0·0054	0 077

(A normal fœtus should contain 0·03 per cent. of iodine on fresh weight.)

Pasture analysis for iodine in another pasture adjacent to the one in which deaths occurred gave the following results : 38 gammas, 42·45 gammas, 53·56 gammas.

An analysis of pasture samples carried out in the laboratory of the Chemistry Section, Department of Agriculture, gave the following results (expressed as percentages of the dried matter, except for iodine) :—

——	Ash.	Crude Silica	Soluble Ash.	Iron (Fe)	Alumina	Phosphoric Acid	Calcium Oxide	Magnesium Oxide.
Chewings fescue	8 92	5·88	3·04	0·014	Trace	0·45	0·44	0·23
Blue tussock ..	6·25	4·07	2·18	0·016	Trace	0·29	0·27	0 17

——	Chlorine	Iodine in Gammas per 100 Grammes Dry Material.	Manganese (Mn)	Sodium Oxide.	Dipotassic Oxide.	Nitrogen.	Sulphur.
Chewings fescue ..	0·275	42–15	0·068	Trace	1 12	1·61	0·15
Blue tussock ..	0·29	..	0·006	0 06	0·91	1·18	..

The analysis shows a sufficiency of iodine in the animal and in the pasture. There is, however, a very low mineral content in the pasture, and the blue tussock was much worse than the Chewings fescue. Sodium chloride, also, is notably deficient, but that is so all through the district.

No analysis has yet been made of the bones of the ewes, to ascertain whether the deficiency of minerals in the pasture could have caused a definite deficiency in the body of the ewe in the short time of gestation.

(4) *Sheep Husbandry and Pasture*.—The type of pasture appears to have a very great deal to do with the condition under discussion. In all cases the ewes have had access for a large part of the gestation period to coarse fibrous grass of a very low nutritional value. Many flocks have been fed on turnips with a run-off on to fescue or tussock (a mixture of *Poa colensii* and other poor grasses being included), but other cases have occurred among ewes run on the rough pasture alone so as to avoid overcondition at lambing. It has been a striking fact that ewes placed on good grass-paddocks—*i.e.*, rye, clover, and cocksfoot—have shown no sign of the trouble.

So impressed are the farmers where the deformities have been found that rough pasture is at the bottom of the trouble that they are either getting rid of fescue altogether, or keeping stock on turnips alone or on English grasses during gestation—practices which have given them relief from the trouble. It is difficult to arrive at a reason for the deformity and for the œdema of the uterus from the observations made, but something may result from experimental work planned for next lambing-season.

In order to overcome the losses farmers are advised to keep ewes off rough pasture during gestation, and where a run-off from turnips is required to see that the pasture is short and good. Especially should ewes be kept off fescue. If fescue-paddocks are a necessity they should be grazed closely and no roughage allowed to accumulate. It might be possible to let wethers eat this type of feed out earlier in the season.

The experimental work in hand is briefly as follows :—

(1) Twenty ewes and one ram were obtained in the North Island, their breeding history being irreproachable. These have been sent to a selected farm in an affected locality, and are being run on Chewings fescue with the object of finding whether their lambs will become deformed. They will possibly be kept two years on this farm.

(2) Two ewes were thyroidectomized at the Wallaceville Laboratory with a view to breeding from them. One ewe died from post-anæsthetic pneumonia, but the other has been put out with the ram. A third ewe is to be operated upon after tupping.

FARMERS' EXPERIENCES.

The following is a summary of experiences gathered with the assistance of Mr. D. Weir, Inspector of Stock, Ranfurly, from local farmers :—

J. A. (Hyde).—In this case there were 150 deformed lambs among 300 half-bred ewes, four-tooth, in 1928. The same ewes, as two-tooths in 1927, bred to Romney rams, had no deformed lambs in a 100-per-cent lambing, but they were grazed on a different type of pasture, a rye and clover mixture, with an occasional change to 150 acres, half of which was mixed English grass pasture and the remainder Chewings fescue. The 1928 winter was spent on rank Chewings fescue and tussock alternately. The same Romney rams were used in both seasons, and came from three well-known breeders. In 1929 160 full-mouth half-bred ewes, bought farther inland on 10th April, were put on rank fescue for six weeks ; Romney rams were with them three weeks ; then changed to English mixed pasture, but brought back on to fescue for a fortnight in July, after which they were on ordinary

pasture till lambing. Forty deformities were produced. The later-lambing ewes of this lot, which would have been tupped on English grass, had no deformed lambs. Deformities were not so marked as in the previous year The 300 ewes which had previously produced deformed lambs were again bred to the same Romney rams, with a few new rams added, and kept for two months on English pasture. They were then sent to good tussock hill-country containing trefoil, clovers, &c., till lambing. The lambing percentage was large. This farmer always has ewes well conditioned at tupping-time. He also believes pulpy kidney to be more pronounced in the flocks affected with deformed lambs.

J. N. (Oturehua).—First trouble in 1926; thirty deformities from 300 ewes, Romneys, merino cross, and Corriedale cross put to Romney rams. In 1927 the same ewes had forty deformed lambs. In both years the ewes were wintered on turnips, with run-off on to old English grass and tussock pasture, till August. They were then placed on rank fescue until lambing in October A cut of these ewes placed on a rye, clover, and cocksfoot paddock at the end of August had no deformed lambs. In 1928 no deformities were seen. The ewes had hay in June, and turnips from 1st July to 20th September, with run-off on old English pasture; then on to English grass till lambing. In 1929 there were six deformities. The flock received turnips from 1st August to 1st October, with pasture and clover hay Six-tooth and eight-tooth ewes from which three of the deformities occurred had a run-off from turnips to a bare fescue-paddock Older ewes, where the other three deformities occurred, had hay on an ordinary grass-paddock and no turnips. Rams were changed each season and bought from different breeders.

D. N. (Oturehua).—First loss in 1926. A few deformities in fifty Romney cross ewes wintered on grass and hay, and put in a rough fescue-paddock from 1st May till lambing. 1927: A hundred deformities in 200 Romney cross old ewes in lamb to good Romney rams Wintered until lambing on rough tussock and fescue paddock, with hay but no turnips. 1928: A hundred deformities from 200 full-mouthed Corriedales by Romney rams. Wintered on rough tussock, with no hay; turnips from August to October, with run-off on fescue. English pasture for lambing. 1929: A hundred deformities in 200 two-tooth ewes (not related to other lots) by English Leicester and Corriedale rams. Wintered on rough fescue-paddock; turnips from 1st August to 1st October, and turned out at nights to bare fescue-paddocks. It is noteworthy that 800 other ewes from English pastures mixed with the 200 two-tooths from 1st August had no deformed lambs. Licks of salt, iodine, lime, and sulphur have been given to the sheep for two years.

W. M. (Kokonga).—In 1928 there were 250 deformities from 800 two-tooth Corriedale ewes by Corriedale rams from well-known and approved pedigree breeders. Grazed on tussock; put to ram on rank fescue for six weeks. Some ewes had turnips, but deformities occurred in spite of these. The ewes remained on the tussock block till lambing. In 1929 there were no deformities. The same ewes and rams were used, but the flock was kept off the fescue-paddock. Kept till lambing on tussock with clover, trefoils, &c., throughout.

E. S. (Wedderburn).—First deformities in 1926; about thirty in 300 two-tooths, while flock made up of 1,000 ewes, crossbreds and half-breds. Whole flock running with ram till 31st July on grass-paddock with natural tussock. Five hundred were then given turnips; of these, 300 two-tooths had a run-off on to natural rough tussock, and 200 had no run-off. Deformities occurred on the tussock run-off only. The remaining 500 ewes were taken to another place in May, six miles distant, after being tupped by the same rams. No deformities occurred. The rams were supposed to be at fault, so were changed for 1927. In that year the flock was treated similarly, but had turnips during August. Ninety-five deformities appeared in a lot of 350 of two-tooth to eight-tooth ewes left on the same paddock as the 300 lot in 1926. The remainder of 800 were in another paddock till 31st August, when they were moved to the property six miles distant. No deformities occurred from these ewes. The run-off from turnips consisted of a natural tussock pasture of 260 acres, which was used from 1st September to 1st October. Ewes of all ages and of two breeds were affected. In 1928, following advice from the Agriculture Department's officers, the owner turniped the ewes as usual, but gave a run-off on to good grass pasture. No deformities occurred. The same rams were used with the same ewes in 1928 as in 1927. Ewes which had deformed lambs in 1927 were marked, but gave birth to normal lambs in 1928.

W. S. (Wedderburn).—The first deformities were seen in 1929, when 520 ewes gave 150 deformed lambs. The ewes had been bought from several different places, and were half-breds and crossbreds. Romney rams were used; 300 of the ewes were tupped in a rough fescue-paddock, and the remainder on rough tussock, and kept there till the end of June. They were put together on 60 acres of turnips on 28th June till 16th September with a run-off on to 200 acres of rough tussock pasture. Each night they were driven off to a second tussock-paddock of 300 acres with no clovers or grass undergrowth. This owner lost many ewes from septicæmia while assisting them to lamb.

Phormium Investigations.—Referring to this matter at a recent meeting of the Research Council, the Chairman stated: "Breeding and selection work is continuing under Dr. Yeates at Massey College, where several promising strains are meriting attention. At the same time "yellow-leaf" disease research is being actively pushed forward. This trouble—possibly being of the virus type—is proving exceedingly difficult of solution. Chemical work is under way, and several methods of softening and bleaching fibre are being actively subjected to investigation.

Yeasts and Moulds in Butter.—Reporting on the organization of the Irish Co-operative Creameries Association, Mr. W. Wright, Inspector of Dairy-produce, London, remarks: "In addition to grading there is a system of taking samples of butter at the grading-store, Dublin, of all boxes of butter graded, both for bacterial and chemical examination. These examinations include yeasts and moulds. Samples for the latter are taken from the butter at the opposite corners of the upper surface of the box. Yeasts and moulds are looked upon here as being intimately connected with dirt due to uncleanliness of utensils, &c., and so much stress has been put on this particular feature that inspectors are advised immediately when butter has been found to contain yeasts and moulds, with instructions to visit the factory where the butter was made and investigate the cause of the trouble."

AN ECONOMIC SURVEY OF DAIRY-FARM GROUPS IN NORTH AUCKLAND, SEASON 1927-28.

(Concluded.)

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2. Dargaville Group—Hobson County.

IN the first article, published last month, a group of dairy-farms at Ruawai, in Otamatea County, was discussed. The present analysis deals with 110 farms near Dargaville, in Hobson County, which is bounded by Otamatea on the south, Hokianga on the north, and Whangarei on the east. A portion of the county is adjacent to Kaipara Harbour, but there is also a long sea-coast line. The major portion of the district is hilly or undulating, and it contains a large proportion of unimproved land. Dairying is carried on along the valleys and tidal flats, but farms are on the whole larger than those dealt with previously.

The total occupied area of Hobson County as given in the 1927–28 statistics was 300,212 acres. Of this area 155,800 acres were improved, including 154,700 acres of grassland; hay and ensilage comprised 227 acres only, while 731 acres were under the plough. Thus it will be appreciated that the county produces little other than grass for stock feed. Stock in the county consisted of the following: Horses, 1,990; dairy cows in milk and dry, 19,006; other cattle and young stock, 24,963; sheep wintered 1928, 121,080; pigs (31st January, 1928), 6,532.

The 110 farms in the Dargaville group milked 4,177 cows, or 21·98 per cent. of the total dairy cows in the county. On a sheep-unit basis dairy cows represented approximately 32 per cent. of the grazing-stock of the county.

BUTTERFAT PRODUCTION, SIZE OF FARM, ETC.

In the first four tables farms have been grouped according to production per acre, cows milked per 100 acres productive area, production per cow, and size of farm respectively. Tables are comparable with those dealing with the Ruawai group in every case.

Table 1.—Farms grouped according to Butterfat-production per Acre (Productive Area).

Butterfat per Acre—Range.	Number of Farms in Group.	Butterfat per Acre.	Butterfat per Cow.	Number of Cows milked per 100 Acres.	Number of Cows milked per Farm.	Productive Area.	Non-productive Area.	Total Area.
lb.		lb	lb			Acres.	Acres.	Acres.
140–159·9	3	150·4	224·1	67·2	53·7	79·3	10·0	89·3
120–139·9	10	129 9	261·5	51·0	35·4	71·5	17·9	89·4
100–119·9	18	111·9	221·8	51·5	34·7	66·0	10 6	76·6
80– 99·9	24	91·1	205·4	45·5	36·6	82·1	11·0	93·1
60– 79·9	20	68·6	196·7	35·3	42·1	122·6	21·3	143·9
40– 59·9	21	51·9	171·5	30·8	39·0	125·8	25·6	151·4
20– 39·9	14	30·4	150·7	20·9	35·5	183·4	49·7	233·1

Table 2.—Farms grouped according to Cows milked per 100 Acres (Productive Area).

Number of Cows milked per 100 Acres—Range	Number of Farms in Group.	Number of Cows per 100 Acres—Average	Butterfat per Acre	Butterfat per Cow	Number of Cows milked per Farm.	Productive Area.	Non-productive Area	Total Area
			lb.	lb		Acres	Acres.	Acres.
60–69·9	10	63·9	123·8	192·9	39·0	60·5	23·3	83·8
50–59·9	15	53·9	112·2	208·3	43·0	79·1	12·3	91·4
40–49·9	25	44·8	96·7	215·7	32·7	73·0	8·9	81·9
30–39·9	35	34·8	70·9	202·7	40·7	117·2	19·5	136·7
20–29·9	18	36·2	45·2	171·4	34·6	131·7	39·8	171·5
10–19·9	8	17·2	27·5	161·6	38·8	228·7	66·8	295·5

Table 3.—Farms grouped according to Butterfat-production per Cow (Productive Area).

Butterfat per Cow—Range.	Number of Farms in Group	Butterfat per Cow—Average.	Butterfat per Acre (Productive)	Number of Cows milked per 100 Acres.	Number of Cows milked per Farm	Productive Area.	Non-productive Area.	Total Area.
lb		lb.	lb.			Acres	Acres.	Acres.
325–349·9	2	337·1	124·8	37·0	27·5	74·0	2·5	76·5
300–324·9	0	..	..	..	..	.	..	..
275–299·9	2	278·9	102·3	36·7	21·5	60·5	2·5	63·0
250–274·9	8	266·5	115·3	43·3	36·6	85·5	7·4	92·9
225–249·9	13	236·8	108·0	45·5	33·0	77·5	8·5	86·3
200–224·9	32	210·2	89·8	42·8	41·5	108·9	18·3	127·2
175–119·9	22	185·7	73·5	39·8	36·5	101·1	28·8	129·9
150–174·9	16	162·2	54·6	33·7	38·8	134·4	25·8	160·2
125–149·9	10	142·5	53·4	37·4	42·3	121·1	45·8	166·9
100–124·9	5	116·0	31·7	27·4	36·8	147·8	10·2	158·0

Table 4.—Farms grouped according to Size of Farm (Productive Area).

Size of Farm—Range	Number of Farms in Group	Productive Area—Average.	Butterfat per Acre.	Butterfat per Cow.	Number of Cows milked per 100 Acres	Number of Cows milked per Farm.	Non-productive Area	Total Area.
Acres.		Acres.	lb.	lb.			Acres.	Acres.
20– 29·9	1	28·0	102·0	238·0	42·9	12·0	3·0	31·0
30– 39·9	7	35·5	113·2	216·3	52·9	18·7	10·3	45·8
40– 49·9	10	43·6	109·2	224·5	49·7	21·7	12·5	56·1
50– 59·9	10	54·1	102·0	231·5	43·7	23·6	7·6	61·7
60– 69·9	10	62·9	83·9	193·7	43·4	27·3	19·2	82·1
70– 79·9	8	73·9	65·4	188·8	34·6	25·6	13·1	87·0
80– 89·9	10	85·0	79·8	177·6	45·0	38·1	19·6	104·6
90– 99·9	8	93·8	82·4	207·6	38·5	36·1	6·8	100·6
100–109·9	10	103·2	70·1	178·2	38·9	40·2	25·7	128·9
110–139·9	10	122·2	94·8	221·8	42·2	52·0	9·8	132·0
140–169·9	10	152·7	50·9	172·8	28·7	44·1	59·0	211·7
170–199·9	4	192·0	64·8	166·9	36·7	70·8	46·2	238·2
200–299·9	11	231·9	50·0	177·9	27·7	63·7	39·6	271·5
300–399·9	2	373·5	29·4	186·5	16·2	60·0	92·5	466·0

A number of interesting comparisons may be made between the figures pertaining to the Dargaville and Ruawai groups. The area of non-productive land is considerably higher on Dargaville farms than in

the case of Ruawai. Despite this fact and the possible advantage which may be given if the areas assessed as non-productive are too high, production per acre does not reach the level of the top farms in the Ruawai group. The factor accounting for this position is the lesser number of cows milked per given area, and the range of cows milked shows a much wider variation. The influence of the density of milking-cows more than counterbalances the higher-producing animals found on a few farms in the Dargaville group. The wide range of productive area (Table 4), taken in conjunction with the number of cows milked per farm, clearly illustrates that many of the Dargaville farms are not highly improved even on that area shown as productive. Generally speaking, dairying is not in such an advanced state as in the Ruawai district.

Top-dressing and Labour

It will be seen that top-dressing is not extensively practised, being in approximately the same stage as at Ruawai. The remarks in the preceding article pertaining to manuring and labour apply equally to the position shown here in Tables 5 and 6.

Table 5.—Manure used for Top-dressing: Farms grouped according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range	Amount of Manure.			Lime per Acre (not included in Manure)	Number of Farms in Group
	Per Acre	Per Cow	Per Pound of Butterfat.		
lb	Cwt.	Cwt	lb.	Cwt	
140–159·9	1·5	2·3	1·2	..	3
120–139·9	1·9	3·6	1·4	0·6	10
100–119·9 . .	1·5	3·0	1·5	0·4	18
80– 99·9 .. .	1·2	2·7	1·5	0·3	24
60– 79·9	0·9	2·7	1·5	0·5	20
40– 59·9 .. .	0·7	2·4	1·6	0·3	21
20– 39·9	0·5	2·5	1·9	0·2	14

Table 6.—Labour: Farms grouped according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range	Labour Units per 100 Acres.	Number of Cows milked per Labour Unit	Butterfat produced per Labour Unit.	Number of Cows milked per 100 Acres.	Number of Farms in Group.
lb			lb		
140–159·9.. ..	4·4	15·7	3,504	67·2	3
120–139·9 . ..	4·4	12·3	3,133	51·0	10
100–119·9.. ..	5·0	11·4	2,488	51·5	18
80– 99·9 . ..	3·6	13·5	2,783	45·5	24
60– 79·9.. ..	2·4	16·3	3,184	35·3	20
40– 59·9.. ..	2·4	14·4	2,339	30·8	21
20– 39·9.. ..	1·5	15·4	2,336	20·9	14

Gross Returns.

It will be noticed that in groups of comparable per-acre production range gross returns per 100 acres are lower than at Ruawai. This is accounted for by lesser returns from pigs, and a more serious position

in the cattle account. The position is uniformly lower over the whole range, which indicates that the average conditions obtaining on Dargaville farms offer considerable scope for improvement.

Table 7.—Gross Returns Farms grouped according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range	Gross Returns per 100 Acres.	Number of Cows milked per 100 Acres.	Gross Returns per Cow
lb.	£		£
140–159·9	1,000	67·2	14·88
120–139·9	1,006	51·0	19·73
100–119·9	828	51·5	16·08
80– 99·9	709	45·5	15·58
60– 79·9	530	35·3	15·01
40– 59·9	402	30·8	13·05
20– 39·9	261	20·9	12·49

Maintenance Expenses.

Expenses of maintenance are lower in the Dargaville than in the Ruawai group. Drainage rates affect only five farms, which materially reduces costs. Owing to the fact that farms are generally larger and contain at least a proportion of dry land, wintering-off is not so extensively practised. Of the whole group only twenty-nine farms winter stock away, resulting in a distinct saving in annual expense. Although a reduction in maintenance expenses has been effected in this way, it is undoubtedly mainly responsible for the lesser per-acre production as compared with the Ruawai group, and the adoption of more wintering-off in the Dargaville area is a question worthy of consideration.

Table 8.—Expenses: Farms grouped according to Butterfat-production per Acre (Productive). (All Figures per 100 Acres.)

Butterfat per Acre—Range	Manure.	Rates.	Fences	Cultivation.	Power	Winter Grazing	Depreciation	Sundries.	Total.	Cost per Cow milked.
					Actual Cost.					
lb	£	£	£	£	£	£	£	£	£	£
140–159·9	46·2	33·8	5·1	10·3	27·2	7·0	11·7	44·2	185·5	2·76
120–139·9	55·1	37·9	21·3	2·5	21·1	5·0	16·6	33·8	193·3	3·79
100–119·9	49·7	36·0	9·8	16·2	15·2	14·9	17·9	24·1	184·1	3·57
80– 99·9	34·9	35·4	7·8	8·2	19·7	13·2	13·2	18·8	151·2	3·32
60– 79·9	33·9	23·0	4·3	6·8	11·7	2·1	11·6	15·7	109·1	3·09
40– 59·9	24·3	19·2	11·2	5·4	7·5	4·8	10·8	10·9	94·1	3·06
20– 39·9	17·9	15·2	3·6	7·1	6·2	2·4	7·1	11·1	70·6	3·38
					Percentage of Total.					
140–159·9	24·9	18·2	2·7	5·6	14·7	3·8	6·3	23·8	100	..
120–139·9	28·5	19·6	11·0	1·3	10·9	2·6	8·6	17·5	100	..
100–119·9	26·9	19·6	5·3	8·8	8·3	8·1	9·7	13·3	100	..
80– 99·9	23·1	23·4	5·2	5·4	13·0	8·7	8·7	12·5	100	..
60– 79·9	31·1	21·1	4·0	6·2	10·7	1·9	10·6	14·4	100	..
40– 59·9	25·8	20·4	11·9	5·7	8·0	5·1	11·5	11·6	100	..
20– 39·9	25·3	21·5	5·1	10·1	8·8	3·4	10·1	15·7	100	..

Distribution of Gross Returns.

In Table 9 the effect of low maintenance expenses and a comparatively low labour reward resulting from the smaller number of cows milked per 100 acres is reflected in certain sub-groups in the interest surplus. This is especially noticeable in the second sub-group, where the number of cows milked drops from 67·2 to 51 per 100 acres. Thus, with this sub-group, if family labour only is depended upon, the interest surplus becomes inflated at the cost of the family reward for labour. This is a typical instance of where a higher price may be paid for land than is warranted by its production, through an underestimation of the worth of labour

Table 9.—Distribution of Gross Returns. Farms grouped according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range.	Number of Farms in Group	Maintenance		Labour.		Interest		Total.	
		Per 100 Acres.	Percentage of Total.	Per 100 Acres.	Percentage of Total.	Per 100 Acres.	Percentage of Total.	Per 100 Acres.	Percentage.
lb.		£		£		£		£	
140–159·9	3	185	18·5	470	47·0	345	34·5	1,000	200·0
120–139·9	10	193	19·2	357	35·5	456	45·3	1,006	100·0
100–119·9	18	184	22·2	361	43·6	283	34·2	828	100·0
80– 99·9	24	151	21·3	319	45·0	239	33·7	709	100·0
60– 79·9	20	109	20·6	247	46·6	174	32·8	530	100·0
40– 59·9	21	94	23·4	216	53·7	92	22·9	402	100·0
20– 39·9	14	71	27·2	146	55·9	44	16·9	261	100·0

Interest Surplus.

The following table illustrates the effect of the point just noted, the interest surplus being converted into a high gross capital as a result of low maintenance expenses and labour reward.

Table 10.—Interest Surplus and Capital. Farms arranged according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range	Number of Farms in Group	Number of Cows milked per 100 Acres.	Interest Surplus per 100 Acres.	Gross Capital represented at 7 per Cent
lb.			£	£
140–159·9 ..	3	67·2	345	4,929
120–139·9 ..	10	51·0	456	6,514
100–119·9 ..	18	51·5	283	4,043
80– 99·9 ..	24	45·5	239	3,414
60– 79·9 ..	20	35·3	174	2,486
40– 59·9 ..	21	30·8	92	1,314
20– 39·9 ..	14	20·9	44	629

Owing to a lesser number of cows being milked per 100 acres, the value of stock and plant is also lower throughout than in the Ruawai group. This again tends to show a better capital position on land and improvements, as shown in Table 11.

Table 11.—Farms grouped according to Butterfat-production per Acre (Productive)

Butterfat per Acre—Range	Number of Farms in Group	Number of Cows milked per 100 Acres	Gross Capital	Valuation of Stock and Plant	Net Capital—Land and Improvements	Value of Land and Improvements per Cow milked
lb			£	£	£	£
140–159·9	3	67·2	4,929	1,017	3,912	58·21
120–139·9	10	51·0	6,514	902	5,612	110·04
100–119·9	18	51·5	4,043	906	3,137	60·91
80– 99·9	24	45·5	3,414	778	2,636	57·93
60– 79·9	20	35·3	2,486	611	1,875	53·12
40– 59·9	21	30·8	1,314	551	763	24·77
20– 39·9	14	20·9	629	380	249	11·91

The combination of low stock and plant values, low maintenance expenses, and comparatively low cow-density has resulted in quite a favourable capital position, both per acre and per cow milked, when compared with the same production sub-groups of the Ruawai district. Table 12 shows the capital position on land and improvements as established above, compared with Government valuation per 100 acres. It will be seen that they run much more evenly than the same tabulation for Ruawai.

Table 12.—Farms grouped according to Butterfat-production per Acre (Productive).

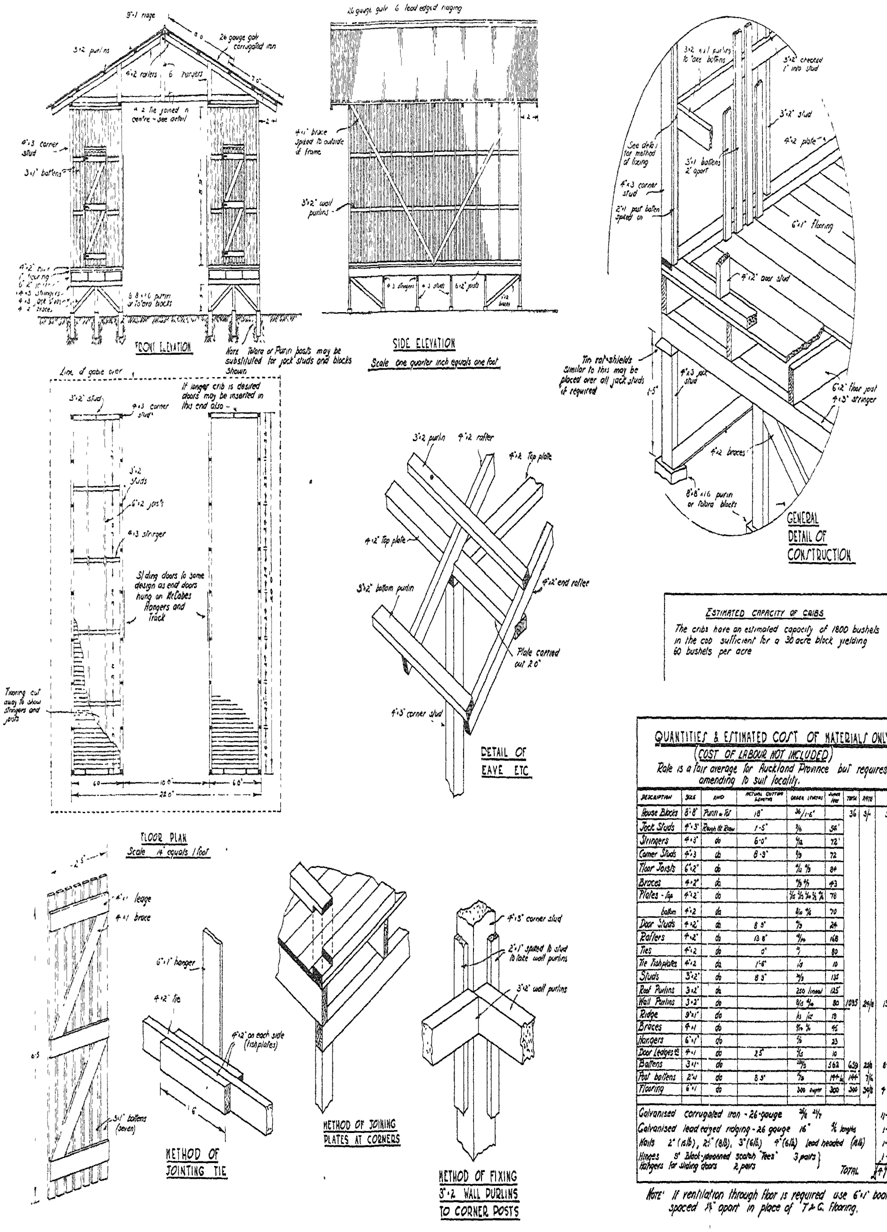
Butterfat per Acre—Range.	Number of Farms in Group	Value of Land and Improvements per 100 Acres	Government Valuation per 100 Acres
lb		£	£
140–159·9 . .	3	3,912	3,304‡
120–139·9 . .	10	5,612	3,118*
100–119·9 . .	18	3,137	3,636
80– 99·9 . .	24	2,636	3,228†
60– 79·9 . .	20	1,875	2,463
40– 59·9 . .	21	763	2,098
20– 39·9 . .	14	249	1,788§

* Two farms. † Nine farms. ‡ Twenty-three farms. § Twelve farms.

Conclusion.

In conclusion, it can be said that the two groups discussed are very similar in so far as expenditure on working and upkeep is low. Both groups have heavy replacement costs and are handicapped through lack of personal capital. Dargaville has the advantage of lesser drainage rates, and is not compelled to winter stock off farms to any extent. On the other hand, the ratio of non-productive to productive land is higher, and where non-productive land has even a moderate capital indebtedness it must become a menace to the productive area on which it depends for payment of interest. The fact that wintering on the farm restricts the capacity for milking-cows puts Dargaville in a less advantageous position so far as labour reward is concerned. If the same results were obtained with a lesser amount of labour it would be a decided advantage, but such is not the case.

Attention must again be called to the fact that the season under review had a dry period which affected production to some extent.



ESTIMATED CAPACITY OF CRIBS

The cribs have an estimated capacity of 1800 bushels in the cob sufficient for a 30 acre block yielding 60 bushels per acre

QUANTITIES & ESTIMATED COST OF MATERIALS ONLY
(COST OF LABOUR NOT INCLUDED)
Rate is a fair average for Auckland Province but requires amending to suit locality.

Description	Size	Kind	Actual cutting lengths	Order lengths	Super feet	Total	Rate	
House Blocks	8"8"	Puriri or Tot	18"	36/1-6"		36	3/-	5·8·0
Jack Studs	4"×3"	Rough Ht. Rimu	1-5"	3/6	54'			
Stringers	4×3"	do	6-0"	6/12	72'			
Corner Studs	4"×3	do	8·9"	4/9	72			
Floor Joists	6"×2"	do		4/12 4/9	84			
Braces	4×2"	do		4/9 4/7	43			
Plates - top	4"×2"	do		2/12 2/13 2/10 3/12 4/6	78			
bottom	4"×2	do		8/10 4/6	70			
Door Studs	4×2"	do	8 9"	4/9	24			
Rafters	4"×2"	do	13 8"	18/14	168			
Ties	4"×2	do	0"	10/2	80			
Tie Fishplates	4"×2	do	1'-6"	1/12	10			
Studs	3"×2"	do	8 9"	30/9	135			
Roof Purlins	3×2"	do		250 lineal	125'			
Wall Purlins	3×2"	do		8/15 4/10	80	1035	26/8	13·9·5
Ridge	9"×1"	do		1/13 1/12	13			
Braces	4×1	do		8/14 3/6	45			
Hangers	6"×1"	do		4/6	23			
Door Ledges etc	4×1	do	2 5"	4/15	10			
Battens	3×1"	do		225/9	562	659	25/-	8·2·6
Post battens	2"×1	do	8 3"	16/9	144 lin.	144'	7/6	10·9
Flooring	6"×1	do		300 super	300	300	30/6	4·12·0

Galvanised corrugated iron - 26-gauge 26/6 21/7	11·17·0
Galvanised lead edged ridging - 26 gauge 16" 5/6 lengths	1·10·0
Nails 2" (15lb), 2½" (8lb), 3" (6lb) 4" (6lb) lead headed (18lb)	1·2·6
Hinges 9" Black-japanned scotch "Tees" 3 pairs; Hangers for sliding doors 2 pairs	1·4·6
TOTAL	£49·16·8

NOTE: If ventilation through floor is required use 6"×1" boards spaced ¼" apart in place of T & G. Flooring.

IMPROVED TYPE OF MAIZE-CRIB AND IMPLEMENT SHED.

Suitable for areas up to 18 acres, where crop averages about 50 bushels per acre.

To face page 306.]

In addition to the two groups discussed a survey of dairy-farms in the vicinity of Whangarei was made. It is, however, not considered advisable to publish the figures, as the dry summer experienced in 1927–28 had a very serious effect on the volcanic soils of the Whangarei district.

CORRECTION.—In the second column of Table 7 in the first article (April *Journal*, page 248) the sign " lb " should be " ± "

STORAGE OF MAIZE ON THE FARM.

IMPROVED TYPES OF CRIB.

C. WALKER, H.D.A., Instructor in Agriculture, Fields Division, Te Puke.

AT this time of the year, with the maize crops approaching maturity, some attention will be paid on most maize-growing areas to the renovation or construction of cribs for the storage of the cobs, until such time as the grain has fully matured and market prices are sufficiently attractive to induce the growers to commence shelling. This delay in shelling, becoming more pronounced each year, should logically result in the growers providing better storage conditions for the cobs, so as to eventually handle their grain to best advantage.

In the earlier days of maize-growing in the Bay of Plenty it was considered that shelling of the cobs should follow their storage for six to ten weeks in the crib, and it was seldom that a much longer period was allowed to elapse on most of the farms where the crop was grown. Consequently storage provision was often of a temporary nature, and as the practice of holding the crop for longer periods developed this storage was often quite inadequate, especially where crops were held for as long as twelve months.

Of the cribs then built the most satisfactory for the smaller growers was the tapering (from top to base) form. Such a crib was usually 8 ft. to the eaves, 5 ft. wide at the base, 7 ft. wide at the eaves, and varied in length, according to requirements, from 12 ft. to 25 ft. As the tapering sides were subjected to severe strains when the crib was filled it was found necessary to provide wall supports in the structure, spaced at 3 ft. to 4 ft. intervals along each side. With the shorter cribs a door at one end was sufficient for convenience of filling, but where the length approached or exceeded 20 ft. it was found desirable to have a door at each end. In some cases landing-stages were built for convenience in filling, but it was found desirable that these should be movable so that they could be dispensed with at shelling.

A modification of this type of crib has arisen through a desire to reduce expenditure. The sides in this case are vertical, being constructed of saplings spaced at 4 ft. intervals with longitudinal battens to support the wire netting which is used to line the crib. The roof is of the lean-to type. This is perhaps the least desirable of all types when storage is required for long periods, as losses due to birds, mice, &c., are considerable: but where shelling follows harvesting within a

short storage period, or where maize-growing is not a regular practice on the farm, it provides the grower with a cheap means of housing the crop.

On the larger maize areas, where considerable space is required, it is often the practice to build two long cribs—up to 40 ft. each in length and parallel to one another—under the one gable roof, with sufficient space between them to provide accommodation for the various farm implements. Doors for filling are usually provided at each end, with sliding-doors situated midway down the inner sides of the cribs to provide means for feeding cobs to the sheller, which is usually brought into the implement-space to allow of shelling from both cribs without having to move the machine. These cribs, which have vertical walls, are usually 6 ft. wide, 8 ft. to 9 ft. high, and from 20 ft. to 40 ft. in length. In addition to housing implements the space between the cribs promotes air-currents, which materially assist in the drying of the grain. Arising out of the foregoing type there has also been evolved a single crib similar in all respects to each section of the double crib just described.

It is claimed for this type of crib that owing to the vertical walls there is far less strain on the walls than in the case of the type with tapering sides, and consequently there is no necessity to strengthen the sides with wall supports. Furthermore, greater capacity is claimed without increase in expenditure on timber. A somewhat greater overhang of the roof is necessary, however, to protect the cobs as efficiently from the weather. Various other modifications are occasionally encountered, chief of which perhaps is the single crib built on to the back of an implement-shed, but the great majority conform to one or other of the foregoing types.

Recommended Designs.

With the object of providing information on the construction and cost of cribs embodying the most desirable features, drawings, specifications, and estimates were recently prepared by the Agriculture and Public Works Departments for the guidance of growers. Two designs were adopted: (1) A combined double crib and implement-shed, for areas up to 18 acres where the crop averages about 50 bushels per acre; (2) a single crib embodying the features of one storage section of the double type, for areas of 6 to 7 acres at a similar crop average. A copy of the first-mentioned design is presented here in reduced form. A full-size sheet of either design may be obtained on application to the Fields Division.

In explanation of the dimensions given for the cribs it should be understood that heights and widths as specified have been arrived at as the most suitable for promoting best drying conditions. Growers with considerable experience regard 6 ft. to 7 ft. as the greatest width that should be employed in any crib. In regard to height there is a greater range of opinion; but even in this respect few successful growers favour heights exceeding 10 ft., generally 8 ft. is regarded as the most suitable. The length of crib can vary between wide limits, and will depend to a great extent on the quantity of maize to be stored.

The plans and specifications should therefore be regarded more as indicating types to which cribs should conform than as actual standard

sizes. Similarly in regard to the implement space, if greater width is desired it will be necessary to modify the plans accordingly. The estimated costs were based on rates ruling at time of compilation, and it should be noted that they make no allowance for labour.

SITE AND POINTS IN CONSTRUCTION.

Realizing that the chief object in storing maize-cobs in a crib is to provide sufficient aeration to allow the grain to fully mature, it will be at once apparent that choice of site for the crib is of some importance. Air-currents play a greater part in efficiently drying out the grain than does warmth direct from the sun. Consequently, where it can be conveniently arranged, a site near or under a belt of tall trees would be preferred to one in the open, as direct sunlight on the grain bleaches it, thereby making it less attractive when marketed. On no account, however, should a crib be built where the soil is unduly damp, as the moisture in rising has a deteriorating effect on the grain.

It is desirable to have the floor at least 2½ ft. from the ground, so as to allow air to freely circulate beneath as well as around the crib. Rising soil-moisture can then escape easily without in some measure passing into the lower layers of cobs. The flooring itself will be more effective in promoting drying if the boards are spaced so as to allow ½ in. to 1 in. spaces between them. There will be perhaps a slight loss of grain between the boards, but this is comparatively insignificant compared with the benefit derived from the improved aeration of the lower portion of the crib.

Walls and ends should always be timbered vertically with 3 in. by 1 in. battens spaced 1 in. to 1½ in. apart to allow of aeration. In addition it is desirable, although perhaps not essential, to have the crib lined with bird-netting so as to reduce losses of grain. A gable roof is much more satisfactory than one of the lean-to type, as it is easier to provide adequate overhang with this type for protecting the cobs from the weather.

Tin shields are occasionally employed on the blocks in an endeavour to keep out rats and mice, but, owing to the fact that most cribs are not more than 2 ft. to 3 ft. above ground-level, it is doubtful whether their general use could be advocated. Rats in particular would have little difficulty in jumping from ground-level, but fortunately they are not a serious pest in most cribs in the maize-growing areas.

Openness in Cheese.—The Chairman's report to a recent meeting of the Research Council made the following reference to this subject: "At the Dairy Research Institute work is being concentrated upon open texture of cheese, but the experiments so far completed indicate that it will be necessary to resort to fundamental investigations before the cause of this trouble can be ascertained and a remedy therefor prescribed. The chemistry and bacteriology of cheese made by the newer processes of recent years have not been properly worked out, and the Institute, therefore, will be obliged to undertake further original work traversing every stage in the manufacturing process, from the production of milk on the farm to the delivery of the cheese on the overseas markets."

PACKING OF APPLES AND PEARS FOR EXPORT.

SOME FAULTS AND HOW TO REMEDY THEM.

J. A. CAMPBELL, Director of the Horticulture Division.

THE following comments are made and instructions given for the benefit and guidance of packers of fruit for export, with a view to correcting misconceptions that appear to exist and for the purpose of remedying faults in our packing system that have manifested themselves during the season, particularly with respect to the size of fruits frequently found in the maximum and minimum packs.

MAXIMUM AND MINIMUM PACKS.

Some of the unsatisfactory maximum and minimum packs of apples are no doubt due to an incorrect application of the $\frac{1}{4}$-in. variation allowed in sizing; but the majority are apparently due to a desire on the part of the packer to work off larger fruits in the maximum-size packs than the size legitimately constituting the respective pack. This is done by including in the pack a certain proportion of apples smaller than the size the pack calls for, thus making room for the inclusion of a proportion of larger ones than should go to that pack. This practice not only results in a pack faulty as to sizing, but defeats to some extent the fixing of the maximum size of a particular variety, inasmuch as it enables apples larger than regulation to be exported.

The reverse applies to the packing of minimum-sized apples. When the minimum size for Extra Fancy and Fancy grades stood at 234 it was urged that this limit excluded many $2\frac{1}{4}$ in. fruits, by reason of the fact that it took $2\frac{1}{4}$ in. with a considerable proportion of larger apples for a 234 pack to properly fill a bushel export case. As an offset to this contention it was claimed that were the next smaller pack allowed—namely, 252—apples decidedly below $2\frac{1}{4}$ in. would be packed. This was refuted by those advocating the 252 pack, and in support of this contention measured apples of $2\frac{1}{4}$ in. were packed as a demonstration, and it was claimed that 252 of these adequately filled an export case.

In consequence of this the minimum size for the grades referred to was reduced to a 252 pack. Unfortunately, however, the contention that such a pack would result in apples appreciably smaller than $2\frac{1}{4}$ in. being included has been amply verified. Growers in the main are abandoning their original argument that their desire for this pack was to get rid of their $2\frac{1}{4}$ in. apples only, and have fallen back on the count together with the sizing privileges of a $\frac{1}{4}$ in. variation. Thus if $2\frac{1}{4}$ in. apples pack 252, the actual range of sizes permissible in the case according to the variation of $\frac{1}{4}$ in. in our sizing regulations is $2\frac{1}{8}$ in. up to $2\frac{3}{8}$ in. This rendering of the situation is detrimental to our packing standards, but unfortunately the trouble does not cease there, for undoubtedly some growers wilfully employ this pack for the purpose of using up their smaller apples, effecting this by including apples considerably larger than $2\frac{1}{4}$ in., thus making room for apples considerably less than $2\frac{1}{4}$ in. In fact, apples 2 in. and under are not uncommon in these packs.

To overcome the position that has arisen the following procedure will in future apply: The existing variation of $\frac{1}{4}$ in. sizing will stand,

but in all cases of maximum and minimum packs such variations must be upward, not downward. In other words, the size of fruit indicated on the packing chart in connection with any maximum or minimum will be taken as the correct size for the pack, and no fruit of a smaller size—reasonable allowance for error excepted—must be included in the pack; any variation must be toward a larger rather than a smaller sized fruit. For instance, a 252 pack requires a $2\frac{1}{4}$ in. apple, consequently (reasonable allowance for error excepted) no apple of this pack must be smaller than $2\frac{1}{4}$ in. On the other hand, a 96 pack requires a 3 in. apple, consequently where 96 represents the maximum-size pack no apples less than 3 in. in size must be included in this pack, plus, of course, reasonable allowance for error in sizing.

The foregoing, where applicable, also applies to the packing of pears.

FAULTY BULGES.

Then there is the matter of faulty bulges in connection with the full-sized export case. Too great a percentage of these are coming forward with the bulge almost entirely confined to the top of the case. Apart from advice given by local officers, this fault has been publicly referred to on several occasions. It is not sufficient for a packer to wrap and methodically but lightly place the fruit in the case. It is true that fruit requires to be carefully handled, consequently this method of packing is to be commended; but when the case has been half-filled the contents should be firmly pressed down and consolidated in such a way as to bulge the bottom boards, and the same procedure should follow when the packing of the case has been completed.

A lightly packed case with the last layer of fruit almost wholly above the level of the sides of the box, if sent forward to the nailing-press in this manner, must be termed a faulty pack, for not only are the apples of the top layer likely to be cut when the pressure of the lidding-machine is exerted, but the flexibility of the lid is such as to cause it to fall into place before the contents of the case have been properly adjusted, leaving a big bulge on top and a small one on the bottom.

Our present export case has been designed so that the top and bottom boards, while sufficiently rigid to hold the contents of a properly packed case firmly in position, are flexible enough to bend into position without undue injury to the fruit. Were the top boards stiff enough to adjust under pressure the contents of a case packed as previously indicated, so that the bottom boards would be sufficiently bulged, they would be too rigid for the welfare of the fruit. As it is, the adjustment of the lid in the nailing-press cannot be relied upon to equalize the bulge unless previously assisted by the packer in the manner indicated.

In view of the fact that a reasonably equal bulge between the top and bottom of a packed case is readily secured with a little care, and that unequal bulges are objectionable from several points of view, officers of the Agriculture Department at the various inspection points will in future withhold all such faulty cases submitted for export until readjustments have been made.

It is well to note, further, that when fruit-cases are being made up, if there is any noticeable difference in the flexibility in the boards intended for tops and bottoms, the more flexible should be used as bottoms.

EMPIRE WOOL SURVEY.

REPORT BY DR. NICHOLLS ON NEW ZEALAND CONDITIONS.

It will be recalled that Dr. J. E. Nicholls, of Leeds, visited New Zealand last year in connection with a survey of conditions of wool-production within the British Empire, and furnished a short preliminary report to the New Zealand Wool Research Committee, which was published in this *Journal* for April, 1929. The first part of a general interim report, dealing with New Zealand, has recently been issued from Torridon by the British Research Association for the Woollen and Worsted Industries.

In his introduction Dr. Nicholls makes the following explanation: "It will emerge in the report that the attitude of mind preserved throughout has been that which considers the foundations of the industry as a whole resident in the live animal, and that wool, as used in manufacture, is the product at a particular moment of a set of phenomena which are in continuous progression. This results in a fundamental difference in point of view between producer and utilizer, but it is hoped that a common realization of each other's problems will result in progress in the industry as a whole. Further, it is this attitude which has been instrumental in giving rise to this present survey and which has influenced the form of this report."

The report deals with various aspects of the pastoral industry of the Dominion, much of the ground traversed being familiar locally and not calling especially for quotation. Extracts are made here of sections treating of the stud flocks and the wools of New Zealand respectively. The latter section may be regarded as the most suggestive part of the report for our wool-growers. In regard to the flocks, it will be noted that Dr. Nicholls uses the statistics for 1927; there has been no very material change, however, in the relative positions during the two subsequent years. The matter indicated is as follows:—

The Stud Flocks of New Zealand and the Breeding Centres.

The animals from stud flocks influence in time the general standard of the various breeds, and although perhaps the majority of breeders do not use stud rams they are indirectly dependent upon the stud breeders for the quality of their stock and any improvement which may be effected. The 1927 figures record that of the total number of sheep in the Dominion 365,094 were stud sheep entered in the flock-books, 6,759,713 were sheep of a distinctive breed, but not entered in flock-books (including 1,229,346 half-bred merinos), and the number of crossbred and other sheep was 18,524,209. It may safely be said that most of the rams used in ordinary flocks came from the rank of the "sheep of a distinctive breed but not entered," and particularly among the smaller farmers, the breeders of stock for the fat-lamb trade, the indiscriminate use of rams of inferior type is prevalent, and general improvement of the standard of stock in the country could best be attained by education, by demonstration, to the use of higher-grade rams.

The general types of stud sheep may be briefly discussed in the order in which the breeds are recorded in the Official Year-book, 1928.

Merino stud sheep numbered 29,971 in 1927, being confined almost entirely to the South Island, particularly Marlborough, Canterbury, and

Otago The stud flocks have been built up chiefly by the use of stock from Tasmania, New South Wales, and South Australia In more recent years the demand for a bigger, hardier sheep has tended to discourage the use of Tasmanian stock and to encourage importations from South Australia The type generally favoured is that with a good conformation and carriage, comparatively little "development" or wrinkles, with face fairly free from wool to lessen the possibility of snow-blindness, and with a dense, uniform fleece with a plentiful output of yolk Merino sheep other than studs numbered 1,005,807

The sheep of British extraction in New Zealand have generally been developed on rather different lines from their prototypes in Great Britain. Except in the case of the Romney, they are usually bred for the purpose of providing rams for crossbred-lamb production. Particularly in recent years they have been selected in the direction of low-set bodies of good mutton conformation, and always attention has been paid to fleece characters in order that good saleable wool may be shorn from the breeding-stock. One reason for this has been that, even where crossbred flocks are concerned, if it were necessary to keep lambs over for a season the value of the wool has been recognized as of distinct importance Another reason is that a definite wool-breeding tradition exists generally It may be noted here that this is one direction in which the fat-lamb industry has tended to lower the standard of quality in commercial flocks, the most profitable lambs are those which mature most quickly, the best lambs are sold off in the earlier drafts, and the stocks which are held over are usually of the "cull" class. It is, however, noticeable that in the case of those breeders who do not rely entirely upon "flying-flock" ewes for their breeding-stock (they are increasing in number) they are tending to select for retention in their flocks the best of their ewe lambs irrespective of their immediate monetary value as fat lambs.

The Lincoln sheep in New Zealand are more compact, shorter-legged sheep than those found in Great Britain. Their fleece is dense, and they have been kept in large numbers in certain areas, particularly of the North Island, where clearing of bush country has been in progress, their strong wool being found to resist the wear-and-tear from bush and scrub pulling off the fleece. It was found, however, that great difficulty was experienced in rearing the hoggets, and this breed has now been largely displaced by the Romney There were in 1927 10,520 stud Lincoln sheep and 84,482 other.

Numerically the Romney is the most important breed in the Dominion, with 112,002 stud sheep in the North Island and 52,344 in the South Island, and with 2,881,358 "not entered" sheep in the North Island and 429,611 of this class in the South Romney Marsh sheep were among the early importations, and the most famous flocks are descended from one established in the Hutt Valley, near Wellington. With frequent importations of Kentish stock the present flocks have been built up, although the present New Zealand types differ considerably from the English type. A low-set active sheep with a lighter bone, wide shoulders, and well-sprung ribs has been developed, and a great deal of attention has been paid to the fleece, its density having been increased and careful selection practised in most stud flocks to reduce the extent of the coarse-woolled areas on the britch and to eliminate kemp In the North Island there is some controversy as to the merits of the east-coast and west-coast types, as developed in the Wairarapa and Feilding districts respectively.

Generally speaking, the Romney in New Zealand is called to fill many parts and to graze on a wide range of pastures, with the result that different types are favoured in the different localities The districts of Hawke's Bay and Poverty Bay may be mentioned, the latter district providing large numbers of draft ewes which are sent to Canterbury for use as the dams.

of crossbred fat lambs reared on the agricultural plains; and Southland, where the Romney is depastured on the high, wet hills. The purebred Romney lamb matures rapidly and is in good demand for the freezing-works, while aged and cull Romney ewes mated to Southdown rams produce excellent fat lambs.

The variety of habitats occupied by the Romney has resulted in the stud breeders being forced to maintain in their flocks a number of types both of conformation and of fleece character, the breeders in the different districts demanding distinctly different kinds of body and of fleece, while a result of the rapid increase in numbers of the breed has been that drastic culling has not taken place, so that a wide range of variation can be found.

The Border Leicester breed has a numerical strength of 24,411 studs and 69,405 others, the majority being in the South Island. Rams are in good demand, particularly for crossing with Romney ewes to yield a valuable mutton animal maturing more slowly than the Romney and Down types, and therefore meeting a later market. The fleece has been increased in density and fineness, and particular attention paid to the belly wool.

The English Leicester breed was introduced early, and the first cross with the Merino formed the famous "Canterbury mutton" sheep of last century. Its use has now diminished, only 20,402 stud and 55,410 other sheep being recorded, the great majority of these being found in the South Island. The type favoured was again a smaller lower-set sheep than the English type, with a denser fleece, a finer head, and a lighter face. In recent years some breeders have, with importations of British stock, tended to approach the British type, and it is suggested that this has to some extent assisted the decline in popularity.

The Shropshire has declined in popularity, the dark face and the size being objected to by breeders: the 1927 figures record only 4,834 stud and 17,555 other sheep.

The Southdown is increasing greatly in numbers all over the Dominion, there being in 1927 36,630 stud and 79,836 other sheep in the North Island, and 17,420 stud and 16,266 others in the South Island. The type favoured is that popular in England, although there is a tendency to grow a larger frame in certain districts. The distribution of flocks is widespread, and it would seem that some localities are not entirely suited to pure Southdown flocks, trouble being experienced with the lambs and hoggets, which show susceptibility towards foot-scald.

The Corriedale—the inbred half-bred of several derivations, but with the Lincoln strain predominating — provided in 1927 49,841 stud sheep and 886,307 not entered in the flock-book towards the total sheep population of New Zealand. Comparatively few are found in the North Island. This breed is of peculiar interest in that it is the result of a great piece of constructive breeding, and that it serves as an illustration of many points which must be considered in sheep husbandry. As in the case of the Romney, there has been a rapid increase in numbers, with resultant low culling of breeding-stock generally, and at the same time it is largely the case that the important centres of stud breeding are on low land and much improved country. Flocks are also being tried out on country too hilly, too high, or too lightly vegetated. It would appear that the formative period of the breed has been obscured by its popularity. The Corriedale would provide excellent material for a genetical study of fleece and body characters when our methods of analyses of these have been developed.

The remaining breed recorded separately in the 1927 figures is the Ryeland, which is of recent introduction. The breeders of the 3,354 stud and 1,888 other sheep are devoting considerable care to the selection of stock

with dense fleeces free from kemp, and the staple showing a good crimp with few cross-fibres. Some breeders are experimenting with Ryeland-Romney crosses for breeding purposes

The Wools of New Zealand.

New Zealand wools generally possess good lustre and are light in condition. As previously noted, features in the history of wool-production have been the decrease in Merino a subsequent decrease in half-breds, and later increases in Corriedales and Romneys with other longwools and cross-breds. Opportunities have been secured of examining wools of most of the New Zealand breeds on the sheep, and several defects or weaknesses which are of interest to the breeders may be discussed, together with aspects of their production of interest to the manufacturer

In the Merino the development of a stronger constitution has been generally accompanied by a broader or stronger wool, the use of South Australian stock has aided this, and few Merino wools now show the old Tasmanian dark tip Also, a very dense fleece is not in high favour in many of the wetter districts, owing to the difficulty in drying a dense fleece once it is thoroughly wet. The reduction in extent of wrinkling has perhaps assisted the breeders in the selection of the stock with fleeces showing little variations in fibre-diameter between the crests amd troughs of the folds, but possibly more attention could be paid to this point Owing to the severe weather conditions experienced in many districts the wools may appear "ill nourished," with weak tips, with little flow of yolk, in certain seasons following rains great discoloration in the fleece may follow. Also in certain districts—*e g*. in Canterbury—the fleeces, particularly the necks and backs, may contain a large amount of sand and shingle material blown into the fleece in windy weather in dry seasons when the sheep are camped in the river-beds. A defect which has been noted is a tendency, in many animals, for the fleece to become open, short in the staple, and tender on the top of the shoulder.

The Corriedale breed has many interesting features its fleece characters have received particular attention from the breeders, who have striven to preserve the good qualities of the half-bred type of wool. The breed has, however, been called upon to occupy a variety of habitats, with the result that natural conditions, in cases unsuitable to the breed, have exerted an antagonistic effect. For instance, under hard conditions of high hill country the fleece tends to decrease appreciably in weight, to lose density, and to break down generally; again, on limestone country the wool tends to exhibit an undesirable harshness of fibre. Whether or not this is due entirely to the kind and supply of nutritional elements or is in large part due to breeding is a point to be investigated. Indeed, a criticism which may be made generally of Corriedale wool is that harshness, possibly associated with a lack of elasticity, exists It would appear also that animals from the Lincoln-Merino foundations are more liable to this character than are those derived from Leicester-Merino ancestry. Further, though the leading breeders have selected for evenness in quality over the body, a great variation exists in this respect in many animals. It may be that the widespread occurrence of this is due in part to the rapid increase in numbers of the breed and its breeders. The successful establishment of a definite crimp in many flocks has not been extended to the majority, many cross-fibres exist, the fleece does not open freely, and there is a tendency for the fleece to break down along the lines of "short shed" separating "fleece wool" from "belly wool" A point to which attention may be drawn is the occurrence of a mosaic arrangement of coarse and fine fibres even in the finer regions of the fleece. Kemp is also of fairly frequent occurrence, even on the rump and back It must be remembered that one

of the reasons for the establishment of the Corriedale breed was the desire for a good-woolled sheep; and particularly at the present time, when improved pastures have become general, with consequent better nutritional conditions in the lower breeding-areas, it is even more important that the production of good sound wool *which will not break down under less favourable conditions* should be the first consideration of the breeders of stud and flock rams.

Among the wools of the crossbred types most opportunities have been presented of studying the Romney breed and its crosses. In the course of these studies certain characters of the fleece which could be subjected to general improvement have been noted; it should, however, be clearly appreciated that until the precise nature of the development of these characters is more fully understood the task of improvement must proceed in only a superficial way.

The value to the breeder of the fleece is made up of the products of length, density, fleece area and uniform distribution of the characters of manufacturing value. (To these may be added protective value.) The breeders' difficulties have lain in the lack of information as to the interrelations of the various characters and their respective values in the ultimate use of the products.

To consider briefly some of the obvious characters involved, bearing in mind that few of these points raised have been critically and scientifically examined as yet:—

(*a*) *Extension of Fleece and the Kind of Face and Leg Covering.*—The greater the body area the more wool produced, other things being equal. The breeders like, under certain conditions, the fleece to be extended on to the poll and well down the legs and to be carried well on the abdomen. Some of these areas are, however, those which can be considered as normally hair-producing, and the presence of hard, coarse hair on the face and legs, in contrast with smooth hair, is usually associated with the presence of kemp or hair in the fleece, and also of harshness in the wool. Also, if the "wool" fibres growing on the head, neck, ears, and legs are found to be weak, irregular, and short, this is taken to indicate, from experience, that the fleece will most probably break down with age, becoming less dense, less extended, and particularly weak on the rump, back, and abdomen in later years.

(*b*) *Density.*—Generally the breeders have selected for greatly increased density, neglecting other characters of the fleece. While there is a general association between increased density, decreased length of fibre, and smaller average diameter of fibre, it may be that an optimum density exists for the production of sound, well-grown wool. In other words, it may be suggested that for a given breed there is an optimum amount of "fibre stuff" which may be produced in any particular season, depending upon inherited tendency and nutritional effects. Again, it would seem from microscopic inspection that density may be expressed in different forms: the fibres (the follicles) may be regularly distributed or may be clumped together. The latter arrangement may give rise to irregularities in average diameter between neighbouring groups of fibres.

(*c*) *Average Fineness of Fibre, Length and Uniformity of the Fleece.*—The uniformity of the fleece has been a great concern of breeders, who have, for the majority, selected against obvious coarseness or "hairiness" of the britch. (There is, however, great room for improvement in this respect in the flocks of New Zealand generally.) The subject is complicated; the regional differences in fibre-diameters may possibly be associated with differences in skin-thickness or vertical distribution of follicle groups within the skin. Further, a difficulty is experienced, particularly in the Romney, in keeping "weak" patches off the backs (at the shoulders and rump) and

on the flanks—the wool of these areas being irregular in length, average diameter, and strength, and often giving rise to a "tailly" appearance.

Average fineness must be considered in close association with length, and with its variation in time and structure. Generally speaking, the coarser fibres are longer, include medulla in their structure, and are apparently less elastic; but if such coarse fibres are grouped together in the fleece they can be removed in sorting. However, it is found quite commonly that coarser fibres are mingled with finer fibres, and this apparently forms a much more serious defect, presenting more difficulties in eradication or amelioration. In some individuals the mixture of long, coarse, and short fine fibres may produce the appearance of two coats of fibres on the animal; in the great majority of animals examined it was possible to find, even on the shoulder areas, neighbouring fibres widely different in diameter throughout their lengths. It would seem that this defect is genetical in nature.

Observations also suggest, as in the case of density, that there may possibly be an optimum condition of average fineness in individuals; if, for instance, owing to general or specific deficiencies in nutritional conditions (cf., the familiar "hunger fine" condition) this fineness is exceeded, then general weakness of fibre results (unsound, tender wool).

In another direction the question of average diameter and structure is important; in New Zealand wools a frequent defect is the existence of "thickened tip"—this condition occurring in adult fleeces and being distinct from the lamb coat tip, and being more noticeable in the longwool breeds. The expression of this condition varies greatly, and would seem to bear a definite relation to the time of shearing and/or the nutritional conditions immediately succeeding shearing, as the part of the fibre affected is that formed during the period just after shearing. The reactions of individuals to those conditions which give rise to thickened portions of the fibres may conceivably vary greatly. Closely connected with such gradual changes in diameter and structure is the question of occurrence and intensity of breaks in the fleece.

(d) *Staple Formation and Crimp and the Flow of Yolk.*—Great variation exists in the character of the staple; dense large locks are considered desirable by some breeders, while others prefer smaller locks. Similarly, in the style of crimp, a rolling wave-like crimp may have advantages over a short-phased saw-tooth crimp. In this connection the question of the flow of yolk appears, in that under the same conditions of management and nutrition certain individuals of similar breeding exhibit yolk flowing freely to the distal end of the staple, and in a general way these have soft-handling wool with an absence of "wasty" tip. The whole question of yolk formation and conduction through the fleece is of considerable importance to the breeder. Also, there may be some association between cross-fibres (fibres which do not conform in disposition to the general staple or crimp formations) and the undesirable character of harshness and irregularities in the fibre-diameters.

(e) *Harshness.*—This is a general defect of many New Zealand wools. It can be suggested without any exact knowledge of its nature that its origin lies in the genetical constitution of the individual, that its expression may be affected by environmental or nutritional conditions, and that its occurrence is apparently related to other general characters of the fleece already mentioned.

(f) *Elasticity and Soundness.*—In respect of these characters it must be stated in general that New Zealand wools appear satisfactory, but evidence is not lacking that certain wools show a marked tendency to be defective in one or other, or both, under the slightest environmental provocation.

(g) *Cotting and Matting.*—Though considerable light has been thrown in recent years on the nature of cotted fleeces, it is evident that the predisposing causes are not fully understood. This condition is particularly

common among New Zealand longwool sheep. It may be connected in its smaller degrees of expression with harshness of fibre, presence of crossfibres, and a restricted rise in the yolk.

This list is by no means exhaustive Reference has been made to these points only because they are those which would appear to be of most immediate importance to the producers of New Zealand, and those in which improvements must begin in the hands of the stud and leading flock sheep breeders.

Education and Research.

Dr. Nicholls appends a special report on education and research affecting the wool-producing industry in New Zealand, which is here quoted in full as follows —

Repeated criticisms of New Zealand wools in the press have directed the breeder's attention to the fact that all is not well with his wool Quite apart from the question of how far many of these criticisms are justified and how far they may have originated in a lack of sympathy between those who buy and those who sell, the position has been reached that, generally speaking, the breeder is peculiarly anxious to improve his wool products. He has, however, been prevented by the lack of precise information which may be of assistance to him in his breeding methods and procedure This information can only be made available by education in those principles which have been established by research.

Until recently the educational field has been occupied by instruction in wool-classing and preparation of the clips for sale, by the instructors of the local educational authorities in technical schools, and by courses to the students at the Lincoln Agricultural College and at the farm schools, who have had the advantage of practical work in shearing and handling wool. The Department of Agriculture has a sheep and wool expert who is available for advice to farmers, and who has conducted instructional classes for farmers at various local centres, at these classes also lectures have frequently been given by individuals who have made a study, in their private capacities, of New Zealand wools. These lectures and demonstrations have produced excellent results in focussing the minds of the breeders on particular points in breeding sheep for wool-production; but it can be stated with some assurance that information desired by the breeder has only in part been provided. Lately the Massey Agricultural College has secured the services of a zoologist with experience in wool research, and a research programme has been embarked upon.

It would seem that an educational system whereby the breeders could have access to the latest information on scientific work conducted in other wool-producing countries should be established. There is a genuine feeling that rapid improvements could be made in the general standard of the clip if the defects in stock, preparation in wool, &c., could be pointed out to the breeders as a community. This would involve, for early results, the instruction, preferably by demonstration, of the present generation of breeders. The question of the personnel of such a system is difficult. It is recognized that further information can only be obtained by further careful research, and it is suggested that both services would be handicapped if the research workers were called upon to conduct extensive lecture campaigns and demonstrations.

New Zealand would appear to be particularly suited to the conduct of research investigations upon wool, many breeds, many sets of environmental conditions, and the enthusiastic support of the breeders add strength to this view. At the same time it is questionable whether the Dominion can afford a complete research institution in which all the different aspects

of sheep-breeding can be contemplated and the character of the clip in relation to its manufacturing uses be examined The study of wool-production must be closely identified with the consideration of mutton and fat-lamb production, since sheep husbandry in the Dominion is organized towards exploitation of the dual capacity of the sheep In this direction the study of the sheep must be conducted in close association with workers engaged upon the pastures soil, and other problems of the country It would seem that general empirical experiments on the profitable type of husbandry for given districts is urgently required, and economic study of the conditions of production, particularly in the good wool districts.

In wool-production the breeder is called upon to strike a balance of those characters in his fleece which are of manufacturing value with the characters which he can most readily cultivate and maintain in his flock on his own particular land Assistance can only come from close co-operation with institutions engaged in the study of manufacturing conditions and problems, so that the breeder may be aided in his attempt to balance the characters concerned by the correct weighting of their values to him

It is also important that those persons who are to conduct the research on the production of New Zealand wools should have a training sufficiently comprehensive to enable them to work with a perspective realizing the position of their raw materials in relation to the industry as a whole, and also in such contact with work in progress in other countries and institutions that they may more readily be able to view their own problems in the light of other experience. Again, the question of personnel presents itself It is suggested that—

(1) Immediate steps be taken to secure the co-operation of the British Research Association for the Woollen and Worsted Industries in the examination of New Zealand wools by the techniques already established and in the light of work conducted in other countries

(2) Immediate steps be taken to extend the training of post-graduate research workers in the field of agriculture, zoology, and genetics into the fields of wool research by means of scholarships or fellowships to the above institution for periods of not less than two years, with guaranteed employment on completion of training.

(3) A provisional appointment be made of an officer to visit that institution and familiarize himself with work in progress and the uses of New Zealand wools in manufacture, and to act subsequently as a field liaison officer in New Zealand with that institution and the New Zealand students in training.

(4) Until the training of the above work is complete no definite scheme be embarked upon for the establishment of any actual sheep-breeding research institution.

(5) The work already in progress in New Zealand be encouraged, and that field demonstrations of the economic aspects of wool and meat production be undertaken.

(6) The establishment of a central institution of similar constitution to that of the Dairy Research Institute be contemplated, it being desirable that research on sheep-breeding should not be allied to or obscured in relation with educational institutions or programmes, and should be conducted in an organization with independent control of its experimental material. Such an organization would serve for co-ordination of effort, as the depository of information, with definite powers of co-operation with bodies such as the British Research Association, and as the advisory nucleus in educational campaigns.

SOME NOTES ON STARTERS FOR CHEESE-MAKING

J. B. SAWERS, Dairy Instructor, Palmerston North.

To any cheesemaker following closely the work it must have become apparent at some time or other that it does not necessarily follow that because cooking-temperatures and acidity are the same with different starters the cheese will show the same degree of acidity. Cases are known of starters doing good work at one factory but failing to show much of their vigour at another, yet where a starter known to be clean by a bacteriological examination was taken to another district good results were obtained.

It appears to be fairly common in most districts for cheesemakers to obtain starters from one another. While this practice in some cases is sound, it does not tend to improve the vitality of starters as a whole, especially when such starters may be contaminated. While much care and attention has been and is being given to the daily propagation of starter, there still remains room for further advancement by giving stricter attention to the daily propagation of mother starters, especially when a fresh starter has been obtained from a reliable source

Practical cheesemakers are fully alive to the necessity for obtaining absolutely clean fresh milk for the making of starter. With a view to making sure that the milk attains such a standard, curd tests could be made or samples submitted to the reductose and fermentation test. Extra care could be given along the line of making sure that the milk used for the daily propagation of the mother starter was kept as free from contamination as possible. Pasteurizing and cooling in a separate vessel or container would ensure this to a large extent. By such treatment a higher pasteurizing-temperature would be more quickly obtained and cooling be more rapid. Such a procedure would afford a more reliable method of obtaining suitable milk for the propagation of a new starter from a culture of lactic ferment

Good results can be obtained by pasteurizing half a gallon of fresh milk at a temperature of about 190° F. for one hour and a half, then cooling down to 100° to 110°, at which temperature the milk is held for one hour before pasteurizing again at a temperature of 190° for one hour. The milk is then cooled to 85° as quickly as possible and the culture powder added, the temperature being maintained until coagulation has taken place. Should there then be any danger of acidity developing too far the culture can be cooled down.

The milk could be pasteurized in the same manner for the second and any further propagations desired until such time as the starter was ready for general use.

It is a well-known fact that a starter if allowed to become overripe loses its vitality. Hence the necessity for guarding against this by keeping the starter at an even temperature and using only the minimum amount of culture required to have sufficient acidity

developed at the particular time it is required for use. This treatment is also essential in the case of the mother starter, for on its condition the ultimate success depends.

The maintenance of a good starter depends not only on the selection of suitable milk, but on the care exercised from day to day to prevent it becoming contaminated with undesirable germs. A steam sterilizing-oven into which all utensils used in this connection may be placed and thoroughly steamed for an hour or more is to be strongly recommended. Many of our dairy companies could with advantage go further and have the sterilizing-oven of such larger dimensions as would accommodate all the smaller factory utensils.

FLUE-BARN CURING OF TOBACCO-LEAF.

A STANDARD DESIGN AND NOTES ON METHOD.

C. LOWE, Instructor in Tobacco-culture, Horticulture Division.

As a rule, flue-barns for tobacco-curing are built to a standard size—16 ft. by 16 ft. inside measurement, and 20 ft. to the eaves—the reason being that the manner and methods of curing are the same throughout all tobacco districts. Any alteration in dimensions makes necessary an entirely different system of temperatures, amount of fuel, and times of processing; further, the size stated represents the most convenient capacity. The accompanying plans give all the dimensions and show internal fittings. Full-sized copies may be obtained on application to the Horticulture Division.

The roofing recommended is of malthoid or ruberoid tightly fastened upon closely timbered sarking; this is to make the chamber airtight and to prevent condensation of moisture Iron roofing is not advised, as it is very difficult to make it airtight, and the drip from condensation is very bad at certain stages of the process. Windows in the structure are not recommended, as light—particularly sunlight—has a bad effect upon the colour of the leaf; also, the final heat of 170° to 180° F., if it happens to coincide with a cold southerly snap, is liable to break all the glass and cause great inconvenience and damage at a critical time. As indicated in the elevation drawing, the walls are constructed of poilite sheets over ordinary studs.

The process of curing tobacco-leaf in a kiln is shortly as follows: The barn is filled with 850 sticks of leaf, each stick carrying twenty-two bunches of three leaves of average standard size, 12 in. to 15 in. long, or two leaves 24 in. to 30 in. These sticks are placed about 8 in. apart on the tier poles. The leaf should all be uniformly ripe. The fire is started in the furnace and kept low to maintain a heat of 90° to 92° F. for thirty-six to forty-eight hours, with all vents tightly closed. This forms a saturated atmosphere if the leaf is freshly gathered and full of sap. A hygrometer is used to record the amount of moisture in the air, and a difference of 3° between wet and dry bulbs is correct.

When the leaf in the barn has turned a good yellow colour under these conditions the temperature is slowly raised, and requisite ventilation top and bottom is supplied to carry off the moisture as fast as it

is given off by the leaves. No tobacco-leaf will stand sudden changes at this period, and 2° an hour is the maximum raising-point.

When the blade of the leaf is dry at a temperature of 125° the barn is "fixed," after which all danger is over, and heat can be advanced and ventilation increased. There are no hard-and-fast rules to follow; everything depends upon the experience and understanding of the man in charge Also, barns in different localities and leaf produced under the various cultural conditions have a great influence upon the method to be followed. Another point to be remembered is that as the curing-season advances and the leaves are gathered from higher up the plant-stalk the management of the barn has to be varied. Again, curing in a dry hot season is quite different to the method followed in the wet cold weather. Good curing is thus only possible when undertaken by one who has had some experience.

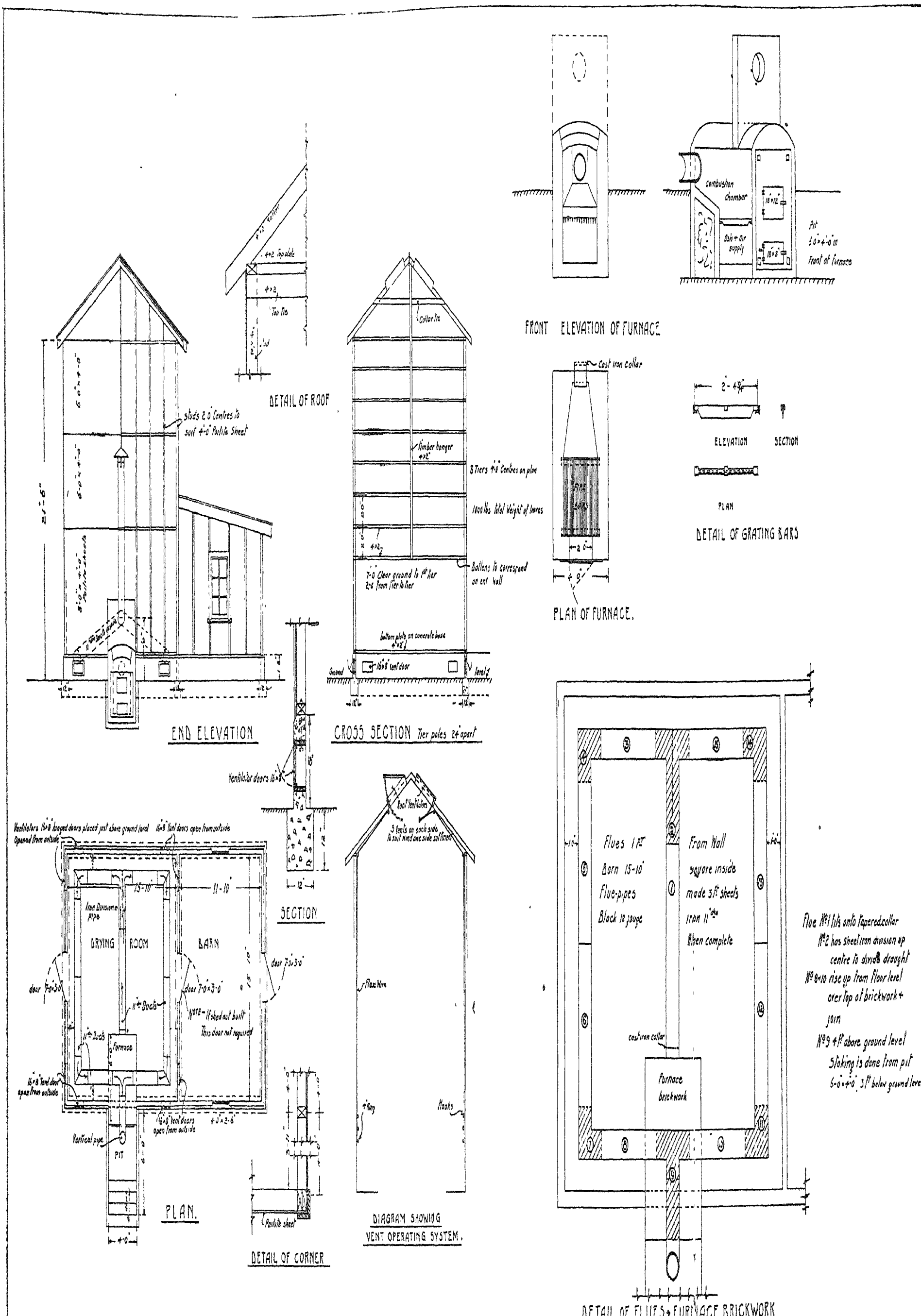
A flue-barn chart is supplied by the Horticulture Division on request, but it should be borne in mind that this chart deals with the first curing of the season. Lower lug leaves, uniformly ripe, are usually cured in dry weather about the first week in February. The cultural methods bestowed upon the tobacco have an immense effect upon the curing methods in the barns. Insufficient cultivation between planting and topping tells a sad story at curing-time. The application of too much nitrogenous manure produces large heavy leaves that will not respond to yellow-leaf curing methods. Again, too long a time spent in filling the barn—say, several days—gives bad results. However, with care and skill it is possible to cure a whole season's crop, even under wet-weather conditions, and produce 90 per cent. of bright yellow leaf.

The difficulties that are to be encountered in flue-barn curing have been mentioned so that those who are considering the matter may not enter upon it lightly, thinking that the erection of a flue-barn is the sum total of the matter. Careful application and attention to the small details are of vital importance in this work.

A flue-barn charge takes from four to five days to process. This, with one day to fill and another to empty, makes an average of a barn a week, which can be reckoned on with a season of about seven weeks' curing.

The tobacco from the flue-barn is removed to a bulking-shed, where it is bulked down upon the sticks—shingled in long rows or built in 4 ft. squares 12 ft. high. It mellows, and the colour improves during the three weeks of bulking. It is then ready for packing. Care should be taken that no tobacco is packed under pressure in cases with the leaf containing less than 12 per cent. or more than 14 per cent of moisture.

Ensilage and Dairy Cows.—In connection with the concluding article on temporary sterility of dairy cows in the March issue of the *Journal*, the writer, Mr. J. Hill Motion, wishes to remove any wrong impression readers may have gained as to his views on the winter and early spring feeding of ensilage. In a note on the matter he states: "The importance of ensilage as a winter feed for dairy cows has been well established in New Zealand. This method of pasture utilization is one which I would strongly urge in connection with the feeding of our dairy herds."



STANDARD DESIGN OF FLUE-BARN FOR TOBACCO-CURING.

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OUTDOOR CULTURE OF TABLE GRAPES.

SOME RECOMMENDED VARIETIES.

J C. WOODFIN, Vine and Wine Instructor, Horticulture Division.

MANY people are under the impression that grapes can be grown successfully outdoors only in hot climates, being unaware that the grape is really a fruit of temperate climates, and that extremes both of heat and cold are unfavourable to the development of its highest qualities.

There are over five thousand varieties of grape-vines actually cultivated in the world, and among these are many kinds suitable for growing throughout New Zealand on favourable sites from Stewart Island to the North Cape. A number of these have been introduced into New Zealand from time to time by the Department of Agriculture from Europe and America, in order to test their suitability for growing under our climatic and other conditions, and some very satisfactory varieties have been selected and made available to the public. The Horticulture Division at the present time has some two hundred newly introduced varieties under observation in its experimental vineyard at Te Kauwhata, Lower Waikato district

Not only are many varieties of vines suitable to our climatic conditions, but they come to perfection on our various soils. As a matter of fact, vines are not very exacting as regards soil, and they produce heavy crops on our poorest lands—gum-lands, light volcanic, and on almost pure sand. What struck me most about the vineyards on my arrival in this country after twenty-five years' residence in the vine-growing regions of Europe was the flourishing condition of the vines and the remarkably heavy crops they were carrying in comparison to what I had seen on the same varieties in Europe.

There is one class of land, however, which should be avoided. The vine has a strong dislike for wet feet, and no attempt should be made to grow it on swampy or wet soil before it has been properly drained. The proximity of trees should also be avoided, as the roots of these are apt to rob the soil of the vines' food. There is, however, little need to use such positions, as there is plenty of land in this country on favourable slopes facing the sun, which is now unprofitable, growing nothing better than manuka, fern, and blackberry, and which is quite suitable for growing grapes to perfection.

Central Otago, among other districts, shows great promise as a future viticultural centre. Grape-vines planted by miners in the early days are still producing excellent fruit, and in order to try the value of further varieties in the district the Horticulture Division planted a test plot of vines at Earnscleugh on the property of Mr. G. W. Marshall, who kindly placed the necessary land at our disposal. A similar plot was planted in the Moutere Hills district, Nelson, on the property of Mr. T. C. Brash, and other smaller plots are kept under observation throughout the Dominion.

The most important centre of table-grape production in the Dominion is situated round the Te Kauwhata experimental vineyard, where there are over thirty private growers who dispose of their fruit on the Auckland market and elsewhere.

One of the principal factors which renders the grape so valuable as a nutritious and sustaining food is the sugar, of which grapes contain more than other fruit in a form known as glucose or grape-sugar, which, requiring practically no digestion, is easily and rapidly assimilated into the blood This property gives grape-sugar four times the value as a food compared with refined cane-sugar. Grapes also contain, besides valuable mineral constituents, vitamins, and fruit-acids, albuminous and fatty matters, yeasts are also present on the skin.

Table grapes can be employed for making the unfermented grape-juice which is now imported from Canada and the United States of America Our Albany Surprise grape is equal to any American grape grown for that purpose; in fact, it is identical with the variety known as the Pierce grape, which is the best Californian variety for making unfermented grape-juice When grapes are plentiful they can be used for making jam, jelly, grape-butter, spiced grapes, pies, pickles, and even vinegar

Grapes grown under glass may always remain more or less a luxury, or a rather costly necessity for the sick, but outdoor grapes in season should be obtainable as cheaply as any fruit grown in this country.

By planting a succession of varieties (we have varieties ripening from early February to the end of April in our experimental vineyard) and by storing the later varieties of grapes in cool store, or in dry dark rooms, as is practised in Europe, with the stems on the bunches in water in which pieces of charcoal are placed to keep the water sweet, grapes may be preserved in good condition for months. Great quantities of grapes are stored in this manner by the growers round about Paris and other populous centres, and are forwarded to the markets as required when the season of fresh grapes is over. I believe such an industry could be created under the dry climatic conditions of Central Otago and along the east coast of both islands.

It is suggested that growers should select a sunny spot on which to plant vines—an acre or two for market purposes or a few vines for home supply. They can be planted so as to take up very little extra room, as a border to vegetable plots or along the sides of the avenue leading to the homestead. In the cooler parts a wall facing the sun could be utilized for the purpose A good time to plant vines or vine-cuttings is during the month of August.

Table-grape Varieties recommended for Outdoor Culture.

For the guidance of intending growers, and for general information, lists of several groups of varieties are appended. It will be noticed that the varieties are arranged by ripening-periods, concerning which some explanation is desirable. The first ripening-period is that of the Golden Chasselas (Chasselas doré de Fontainbleau), which ripens in New Zealand about the end of February or the beginning of March, according to the altitude, aspect, and soil conditions of the vineyard. The precocious varieties ripen their fruit from two to three weeks before the Golden Chasselas; early varieties between the precocious

and first-period varieties; second and third periods approximately two and four weeks later than the Golden Chasselas.

EUROPEAN VARIETIES

Precocious Period.—Black. Gamay hâtif des Vosges. White. Madeleine Alice Salomon.

Early Period—Black: Noire hâtif de Marseille. White: Précoce de Malingre; Agostenga.

Early First Period.—Black. Portugais Bleu. White: Madeleine Royale, Goldriesling Blanc.

First Period—White: Golden Chasselas (Salomon's selection). Muscat Salomon; Lignan. Rose. Chasselas Rose Royal Malvoisie Rose.

Second Period—Black Black Hamburg; Alphonse Lavallée; Cinsaut White: Chaouch, Gradiska; Temprano.

Late Second Period.—Muscat Hambro.

Third Period.—Black: Black Alicante, Mrs. Prince's Muscat. White: Golden Queen

AMERICAN AND AMERICAN-EUROPEAN VARIETIES.

The pure American varieties and American-European hybrids, being more resistant to diseases, are especially suitable for North Auckland conditions; and, requiring less care than the European varieties, are very suitable for planting in the farmer's garden or orchard. Owing to their aromatic flavours the grapes they bear are not always appreciated by those used to the delicate flavours of the European grapes; while others prefer them, as the already large and increasing demand for the Albany Surprise on the Auckland market and for the Iona in Hawke's Bay goes to prove.

Precocious—White: Baco 2–16 (Totmur) (suitable for pergolas).

Early.—Black: Campbell, Worden. White Siebel 5279; Diamond.

First Period.—White. Siebel 5409

Late First Period—Black: Siebel 4643; Siebel 5455. Red. Agawam

Second Period.—White: Niagara Black Albany Surprise (suitable for pergolas) Herbert, Concord Red Iona, Brighton.

PHYLLOXERA-RESISTANT STOCKS

A selection of stocks is available suitable for the various types of soil in the phylloxera-infested areas of North Auckland. Advice as to their affinity for scion varieties and their adaptation to the different soils will be supplied on application.

NOTE.—A number of recently introduced varieties of European, American, and hybrid vines are under observation in the Experimental Vineyard at Te Kauwhata, and will be released during the next and following seasons as they are found to be suitable for New Zealand conditions.

Insignis Pine for Butter-factory Construction.—A dairy company recently advised the Dairy Division that it was considering using insignis pine for heavy rafters and other work in the roofing of an extension to the factory, and inquired whether this timber, with its marked odour, might be detrimental to the cream and butter. The State Forest Service, to which the matter was referred, gave the opinion that no harmful effect would result in this connection.

THE INDIGENOUS FLORA AND VEGETATION OF NEW ZEALAND.

L. COCKAYNE, C M G , Ph D , F R S , Honorary Botanist. State Forest Service.

FOR various reasons the plant-life of New Zealand is of peculiar interest, especially its extreme isolation from other land-masses, its flora of diverse origin but with an astonishing number of endemic species and group after group of wild hybrids, the numerous and often peculiar life-forms of its members, its having developed unmolested by grazing and browsing mammals, and its vegetation, so diversified that only a continent extending into the tropics can claim an equality.

The Flora.

The flora, considering in the first place the *Ferns*, *Fern-allies*, (lycopods, &c.) and *Seed-plants* (trees shrubs, herbaceous plants, grasses, &c.) consists of about 1,848 species—including under this term a good many well-marked varieties—of which 148 are ferns, 19 fern-allies, 20 conifers (only 1 with a cone in the usual sense), 426 monocotyledons (grasses, sedges. liliaceous plants, orchids, &c.), and 1,235 dicotyledons (mostly trees, shrubs, herbaceous and semi-woody plants), and they belong to 109 families (groups of related genera) and 382 genera (groups of related species). Nearly 79 per cent. of this flora is found wild in no other land (endemic), and the remaining 392 species are chiefly Australian (236), and the balance subantarctic South American (58), cosmopolitan in a wide sense (most also Australian), Norfolk Island, Lord Howe Island, and Polynesian ; while a good many of the families and genera are Malayan, which tropical element found its way to New Zealand during a great extension of its area northwards in the early Tertiary period.

The high endemism of the flora is not confined to the species, for there are 39 purely New Zealand genera, some of which are only very distantly related to genera elsewhere—*e.g.*, *Tupeia*, *Dactylanthus*, *Pachycladon*, *Ixerba*, *Carpodetus*, *Myosotidium*, *Teucridium*, and *Alseuosmia*. The specially large families and genera, together with the number of species each contains, are as follows: Families—*Compositae* (daisy family), 258 ; *Filices* (ferns), 148 ; *Cyperaceae* (sedge family), 133 ; *Gramineae* (grass family), 131 ; *Umbelliferae* (carrot family), 89 ; *Orchidaceae* (orchids), 71 ; *Ranunculaceae* (buttercup family), 61 ; *Rubiaceae* (coprosma family), 55 , *Onagraceae* (willowherb family), 45 ; *Epacridaceae* (Australian-heath family), 44 ; *Leguminosae* (pea family), 38 ; *Boraginaceae* (forget-me-not family), 33. Genera—*Hebe* (koromikos), 66 at a low estimate ; *Carex* (sedges), 59 ; *Celmisia* (mountain-daisies), 56 at least ; *Coprosma* (karamus), 48 ; *Ranunculus* (buttercups), 47 at least ; *Epilobium* (willowherbs), 41 ; *Olearia* (daisy-trees), 35 ; *Senecio* (groundsels, mostly ligneous), 35 ; *Poa* (poa grasses), 33 ; *Myosotis* (forget-me-nots), 32 ; and there are 10 other genera with 20 or 30 species, and 11 with from 13 to 19 species. It is not of necessity the large genera which dominate the landscapes, for some of the smallest are of particular moment in this regard—*e.g.*, *Arundo* (toetoe grass), 2 species ; *Desmoschoenus* (pingao), 1 species, which clothes unstable sandhills in the three main islands and extends to the

Chathams, *Rhopalostylis* (nikau-palm), 2 species; *Cordyline* (cabbage-trees), 4 species, *Phormium* (New Zealand flax), 2 species; *Nothofagus* (southern-beeches), 5 species, *Corynocarpus* (karaka), 1 species; and *Leptospermum* (manuka), 4 species

Besides the species and their varieties, the flora contains, according to recent research, no less than 425 groups of hybrids (some with hundreds of distinct forms) between the species; together with many within the species themselves between their varieties, nor is this all, for there are a few well-marked hybrids between certain genera—*e.g.*, *Helichrysum* by *Ewartia* and by *Gnaphalium*, *Hebe* by *Veronica*, *Leucogenes* × *Raoulia* (edelweiss × vegetable-sheep), and *Northopanax* by *Pseudopanax*. How widespread in New Zealand is wild hybridism appears from the fact that hybrids are now known to occur in 44 families and 108 genera; and were it not that many species never come into contact there would be still more hybrids, for certain species which never meet in nature have spontaneously given rise to hybrid progenies when planted side by side in gardens. This new knowledge concerning natural hybridism is already making radical changes in the classification of New Zealand plants, and it may also have a profound bearing on plant classification in general and on theories of evolution.

The ferns, fern-allies, and seed-plants by no means make up the whole New Zealand flora, but in addition hundreds of species have been described of the less highly organized plants (the mosses, liverworts, algae, fungi, &c.), but they certainly do not nearly represent the total number of such.

Coming next to the primary biological groups of which the flora is composed, the following gives the name of each class and the number of species it contains: *Trees* (including 12 tree-ferns), 182; *shrubs*, 316; *semi-woody plants* (including 10 ferns with short trunks), 241; *herbaceous plants* (including 93 ferns, which grow on the ground), 664; *grasslike plants*, 255; *rushlike plants*, 49; *climbing plants* (mostly ligneous, and including 7 ferns), 51, *perching-plants* (both ligneous and herbaceous, and including 26 ferns), 45; *parasites* (mostly ligneous), 17; *water-plants* (all herbaceous), 28. These biological classes are made up of many life-forms—*i.e.*, the outward forms of plants, and the shape, structure, &c., of their organs—which enable them to occupy definite habitats In no few instances a plant can modify its form as its habitat changes or if it moves to a different habitat from that to which it is accustomed. The New Zealand flora is particularly rich in such "plastic species," as they are called. Further, the flora contains quite a number of life-forms rare or wanting in many other floras. Thus there are climbing-plants with extremely long, woody, ropelike stems; shrubs with stiff, wiry, interlaced twigs forming dense masses number about 51, and belong to 16 families and 20 genera; cushion-plants number at least 65, and belong to 21 families and 34 genera, some of them of immense proportions and quite hard, as in the vegetable-sheep (species of *Raoulia* and *Haastia*); leafless shrubs, tall or dwarf, with flattened or "round" stems (mostly species of *Carmichaelia*); the cypress form, the leaves reduced to scales, as seen in various species of *Hebe* and *Helichrysum*, but a form to be expected in the podocarps; trees with leaves bunched together on long trunks, as in the liliaceous cabbage-trees (*Cordyline*) and certain species of the

Australian-heath family (*Dracophyllum*), the tussock form, with some 40 species belonging to 5 families and 19 genera.

Not the least interesting feature in this matter of life-forms is the presence in the flora of 200 or more seed-plants which for a longer or shorter period have a juvenile form quite distinct from that of the adult, while in about 165 species the plant remains for many years—it may exceed fifty—a juvenile, and in these cases such may blossom and produce seed, the tree juvenile below and adult above—two species, as it were, on the one plant. In some instances so different are juvenile and adult that accomplished botanists have described them as different species How widespread is the phenomenon stands out clearly from the fact that these 165 species belong to 30 families and 50 genera, and that 51 are trees, 82 shrubs, 19 woody climbing-plants, 10 herbaceous plants, and 3 water-plants; a few ferns exhibit the same peculiarity. Some of the commonest trees come into the above category—*e.g.*, the kahikatea (*Podocarpus dacrydioides*), the matai (*P. spicatus*), the kaikomako (*Pennantia corymbosa*), the pokaka (*Elaeocarpus Hookerianus*), the lancewood (*Pseudopanax crassifolium*), and others.

Taking the flora as a whole, a large proportion of the species are evergreen; conspicuous flowers are far from common; annuals and plants which die yearly to the ground are rare; water-plants are few in number, turf-making grasses are not abundant; and bulbous plants are almost negligible

Altitude, on the one hand, and proximity to the coast, on the other, have a profound bearing on the distribution of the species. Thus about 140 species are confined to the coast-line or its immediate vicinity, and 9 families and 35 genera containing 41 species are virtually coastal. Then there are about 560 species which are confined to the lowlands and lower hills, and there are no less than 24 families and 103 genera which are purely lowland. Finally, there is a plentiful high-mountain flora, with about 510 species belonging to 38 families and 87 genera, which never descend to the lowlands, but as compared with the lowland flora the number of genera (only 16) confined to the high-mountain belt is trifling.

Latitude has also a strong bearing on plant-distribution, and, apart from a gradual change, there are three critical parallels of latitude—36° S., 38° S., and 42° S.—near which (it may be somewhat to the north or south of the line) many species attain their southern limit On the other hand, Cook Strait and Foveaux Strait are of but little moment as barriers to advance or retreat. Far greater is the influence of wet and dry local climates, which is most striking when two scuh areas impinge on one another as in the case of the wet area which extends from the Tasman Sea to near the eastern base of the Main Divide, which is forest-clad to the timber-line, and the dry area extending thence to the east coast, which is clothed with tussock-grassland. In the dry area of Marlborough and the contiguous wet western area of north-western Nelson there are 36 species confined to the dry area (locally endemic) and 39 to the wet area. So, too, dry Central Otago possesses 15 locally endemic species Speaking of the distribution of the species in a wide sense there is every transition, from those which extend continuously from the north of the North Island to Stewart

Island to those found in only one limited area (*e.g.*, *Cassinia amoena*, near the North Cape; *Xeronema Callistemon*, on the Poor Knights; *Dracophyllum Townsoni*, on the Paparoa Range), or those occurring only in two or three distant localities (*e.g.*, *Metrosideros Parkinsonii*, in north-western Nelson and Great Barrier Island, *Pittosporum patulum*, near Lake Hawea and in north-western Nelson, *Adiantum formosum*, near Dargaville and in the Manawatu Gorge and it immediate neighbourhood

The Vegetation.

The physical features of New Zealand; its many types of climate, especially with regard to the annual rainfall and the number of rainy days, its varied altitude, ranging from sea-level to the snowfields of the Southern Alps; its many kinds of soils, particularly their water-holding capacity; the diverse frost-tolerating ability of the species; their aggressive powers—largely a matter of their life-forms and inherent plasticity—all these and other factors have led to a most varied vegetation made up of a host of plant communities, some of which appear out of place in the Temperate Zone. Thus between tide-marks in the northern rivers and estuaries there is a true mangrove community—an unexpected occurrence outside of the tropics; and even so far south as north-western Nelson groves of tall palm-trees are a striking feature. But, more than all else of an unexpected character—though familiar enough to all New-Zealanders—is the lowland forest, which resembles in no whit the forests of temperate Europe, Asia, or America, but is a true tropical rain-forest. This tropical character is shown in its groups of tall tree-ferns, which may exceed 40 ft. in height; in its wealth of ferns of all kinds; in the abundance of woody, ropelike climbing-plants and huge perching-plants far up in the forest canopy; in the several tiers of undergrowth, consisting of low trees and tall shrubs with smaller shrubs and ferns beneath, and the ground clothed with a deep carpet of filmy ferns, liverworts, and mosses, while the tree-trunks are similarly clad; in short, the forest exhibits prodigal luxuriance of growth, and Nature, as it were, runs riot. Rarely does one tall canopy tree dominate, but the uppermost story of the forest is constructed out of the crowns of various kinds of trees growing side by side, just as the undergrowth is composed of many species. But no forest is homogeneous in its structure, for differences in the topography of the area, in the water content of the soil, and in the relative amount of light in the interior of the forest, lead to various combinations of species. All the same, especially so far as the tall trees are concerned, there is an advance towards stability and uniformity, so that all the forests if not interfered with are progressing towards a "climax association," as it is named, with (as a rule) the tawa (*Beilschmiedia tawa*) dominant to the north of latitude 42°, and the kamahi (*Weinmannia racemosa*) dominant southwards

Taking the New Zealand forests of all kinds for the whole of the region, their species number 498 (ferns and their allies 121, conifers 19, monocotyledons 70, dicotyledons 288), and they belong to 70 families and 167 genera, the largest of which are: Families—Ferns, 114; *Rubiaceae*, 34; *Compositae*, 32 (but most are confined to subalpine scrub-forest); *Cyperaceae*, 25; *Orchidaceae*, 23; *Pittosporaceae*, 21;

Myrtacaea, 18; *Araliaceae*, 14. Genera—*Coprosma*, 32; *Pittosporum*, 21; *Hymenophyllum*, 19; *Blechnum*, *Uncinia*, and *Olearia*, each 12, *Metrosideros*, 11. As for the biological groups of forest, they are as follows: Trees, 151 (but a good many are frequently shrubs also); shrubs, 84; herbaceous and semi-woody plants, 56; grasslike and rushlike plants, 29; climbing-plants, 33, perching-plants, 17; parasites, 14; and ferns, 114.

The considerable number of species for the whole New Zealand community may easily lead to an exaggerated estimate of the number of species to be found in any ordinary piece of forest, even though of considerable extent. Thus extensive pieces of lowland forest to the north of latitude 42° may possess from 150 to 180 species, and to the south of this parallel from 140 to 160 species, while 125 species is a fairly high estimate for Stewart Island.

Another class of forest, though usually possessing many rain-forest characteristics, is that where one or more species of southern-beech (*Nothofagus*—there are 5 species and very many hybrids) dominate Such forests extend—but not continuously—from somewhat south of latitude 37° almost to the shore of Foveaux Strait. Generally they are restricted to the mountains, but in places they descend to sea-level in southern Wellington, northern Marlborough and Nelson, and to the west of the coastal mountains of western Nelson and of the Southern Alps. Throughout the high mountains the southern-beech forests generally form the uppermost forest belt, but those of northern and central Westland are a notable exception.

Nothofagus forest differs from lowland rain-forest in possessing about one-half the number of species and in lacking the exuberant richness of the forest interior, due largely to its comparative poverty in small trees, diversity of shrubs, climbing-plants, perching-plants, and ferns, as also to the forest-floor and tree-trunks being but scantily covered, or draped, with filmy ferns, mosses, and the like. A fundamental difference, and one of great economic importance, is that southern-beech forest regenerates into forest of the same class, while rain-forest proper slowly changes into forest dominated by trees of small commercial value, such replacing the valuable timber-trees (kauri, podocarps) when these die; also, all the southern-beeches, as compared with other tall New Zealand trees, are of far more rapid growth.

Where water lies here and there in shallow pools and the soil is always saturated with moisture there is semi-swamp forest which is of a true rain-forest character, though not directly dependent on a heavy rainfall, its composition depending upon the ability of many rain-forest species to tolerate a constantly wet substratum. Its most marked characteristic is the overwhelming dominance of one tall tree, the kahikatea (*Podocarpus dacrydioides*), the tall mastlike trunks of which, standing closely side by side, and their absurdly small crowns, stamp the community as absolutely distinct in appearance from any other type of forest; while in the North Island its physiognomy is made still more remarkable by the astonishing number of asteliads perched on its branches, and resembling gigantic birds' nests. To the north of latitude 42° the pukatea (*Laurelia novae-zelandiae*) is a common lofty tree. The florula for semi-swamp forest as a whole, consists of about 138 species, but of these only 4 species are confined almost exclusively

to the community. The forest under consideration bids fair in a few years to become almost a thing of the past, since the dominant tree is being rapidly converted into timber for butter-boxes, and the ground occupied by the forest is usually of a high class for dairy-farms.

Proximity to the sea leads to a class of forest distinct from the usual lowland type in its composition, in the much lower stature of its members, and in the extreme density of its roof, the last two characters induced by the frequent more or less salt-laden winds The maritime climate favours the presence of trees which will not tolerate frost, so that a number of well-known trees and shrubs are confined, or nearly so, to coastal forest—*e g.*, the kawakawa (*Macropiper excelsum*), the large-leaved milk-tree (*Paratrophis opaca*), the karo (*Pittosporum crassifolium*), the haekaro (*P umbellatum*), the karaka (*Corynocarpus laevigata*), the akeake (*Dodonaea viscosa*), the pohutukawa (*Metrosideros tomentosa*—but the name has recently been altered to *excelsa*, which by the "Rules of Botanical Nomenclature" is correct for the time being, notwithstanding that *tomentosa* has been the sole name for nearly a hundred years !), and the ngaio (*Myoporum laetum*) Several of the above do not extend beyond latitude 38°, and the ngaio alone reaches Southland, so that coastal forest in the southern part of the South Island is made up of those ordinary lowland trees, &c , which can tolerate coastal conditions.

In addition to forest, the other great New Zealand plant-community dependent on climate is tussock-grassland This community is of but little moment in the North Island except on the volcanic plateau and the highest mountains, but in the South Island it was the original plant-covering of most of the country to the east of the Divide of the Southern Alps, excepting northern Marlborough, northern Nelson, and parts of Southland. It extends from sea-level to the upper subalpine belt of the mountains, but is less continuous at high than at low levels. It also occupies some of the lowland and montane river-valleys of north-western Nelson and Westland, and ascends to the subalpine western slopes of the mountains.

There are two distinct types of tussock-grassland—"low" and "tall"—the former distinguished by the dominance of the medium-sized tussocks of *Poa caespitosa* and *Festuca novae-zelandiae* (one or both), and the latter by the dominance of one or both of the much taller and more massive tussocks of red-tussock (*Danthonia Raoulii* var. *rubra*), or snow-grass (*D. Raoulii* var. *flavescens*), and the numerous hybrids between them. Taking lowland and montane low tussock-grassland together, and excluding tall tussock-grassland, since they occupy a far more extensive area, and leaving out of the estimate the 74 or so exotic species now firmly established, the number of species they contain for the whole area is 216 (ferns and fern-allies 10, monocotyledons 66, dicotyledons 140), which belong to 38 families and 104 genera, the largest being: Families—*Gramineae*, 36; *Compositae*, 35; and *Cyperaceae, Leguminosae*, and *Onagraceae*, each 11. Genera—*Poa* and *Epilobium*, each 11; *Carmichaelia*, 9; and *Carex*, *Acaena*, and *Raoulia*, each 7. As for the biological groups, they and the number of species to each are as follows: Trees, 2; shrubs, 31; tussocks, 13; other plants of the grass form, 43; herbaceous plants, 90; semi-woody plants, 30; and ferns, 7. About 85 of the species are drought-tolerating.

Where water can accumulate and remain fairly permanent, yet not too deep to hinder land-plants rooting in the mud, there is swamp. Except forest, no class of vegetation has been so greatly altered by man, or even destroyed, so that really primitive swamps are almost unknown. The florula consists of about 74 species, which belong to 18 families and 37 genera. The following are specially common species: Raupo (*Typha angustifolia*), frequently dominant; New Zealand flax (*Phormium tenax*), dominant in drained swamp; niggerheads (*Carex secta*, *C. virgata*), toetoe grass (*Arundo conspicua*), cabbage-tree (*Cordyline australis*), common koromiko (*Hebe salicifolia*); karamu (*Coprosma robusta*); common coprosma (*C. propinqua*); and many hybrids between the last two. When, as frequently happens, the swamp gradually dries up, the number of shrubs increases and an early stage of semi-swamp forest is produced.

At the present time, especially in the North Island and the north of the South Island, wide areas are occupied by bracken-fern (*Pteridium esculentum*) or by manuka (*Leptospermum scoparium*), for the most part caused by fire, yet as fire was a natural agency in primitive New Zealand in the vicinity of active volcanoes, there would be natural communities of the above character. Both communities if left alone would in time change into forest. Manuka shrubland is a common feature of the Auckland gumlands, where also, in hollows, bogs are abundant, which, as for lowland New Zealand in general, are distinguished by pale hummocks of bog-moss (*Sphagnum*), a small *umbrella-fern* (*Gleichenia circinata*), and a wiry rushlike plant, the wire-rush (*Hypolaena lateriflora*). On these bogs grow several kinds of sundew (*Drosera*) and bladderwort (*Utricularia*).

The vegetation of the high mountains is both of great scientific interest and full of rare beauty. It is composed of no less than 966 species, and it is certain that a good many more species will be discovered. How strongly of New Zealand origin is the flora is revealed by the fact that of the 514 purely high-mountain species all except 16 are endemic, and probably 5 of these are endemic also. The headquarters of the true high-mountain species is in the South Island, their total being 473, as compared with 105 for the North Island, a matter which should cause no surprise since the area for plants above the forest-line is far and away less than in the South Island, where also the average height of the mountains is much greater.

Though the high mountains contain only 16 genera which do not descend to the lowlands, 8 of them are endemic. But there are 40 genera which, possessing but few truly lowland species, are well represented by purely high-mountain species, *e.g.* (to cite some of particular importance): *Danthonia*, *Colobanthus*, *Ranunculus*, *Nasturtium*, *Geum*, *Acaena*, *Pimelea*, *Drapetes*, *Schizeilema*, *Aciphylla*, *Anisotome*, *Dracophyllum*, *Gentiana*, *Myosotis*, *Hebe*, *Veronica*, *Ourisia*, *Euphrasia*, *Plantago*, *Lobelia*, *Forstera*, *Olearia*, *Celmisia*, *Raoulia*, *Helichrysum*, *Abrotanella*, and *Senecio*.

With but few exceptions the most beautiful flowers of New Zealand belong to the high-mountain flora, so that in due season many plant-communities are natural flower-gardens of extreme loveliness. There are the giant buttercups, white and yellow—but nearly all the flowers are of these colours—which may be seen by the acre; the lovely

ourisias, with the flowers in whorls round the stem, tier above tier, as in some of the Asiatic primulas, or the glistening green leaves, as in *O. caespitosa*, may form mats on stony ground bearing multitudes of delicate blossoms, the eyebrights—true alpine gems—their flowers white with a yellow eye or purple throat, or yellow altogether; forget-me-nots, yellow, bronze, purplish, or white; the snow-groundsel, its large marguerite-like flowers produced in such profusion that the mountain-meadow glistens like a snowfield; the two kinds of edelweiss, far surpassing their Swiss elder sister in beauty, the flowers of the "everlasting" kind, their outer leaves flannelly and snow-white. But above all other plants of the mountains, not only for their beauty of flower, leaf, and form, but for their abundance in all situations, come the various species of *Celmisia*. "Go where you will"—to quote from "The Vegetation of New Zealand" (ed 2, p. 238)—"on subalpine and alpine herb-field and their silvery foliage strikes the eye, it may be in stately rosettes of dagger-like leaves, in circular mats trailing over the ground, or in dense cushions. Their aromatic fragrance fills the air; from early till late summer some of their white heads of blossom may be seen, while in due season gregarious species clothe both wet herb-field and dry, stony slopes with sheets of white"

The life-forms of the high-mountain plants are in great variety and frequently of striking appearance. Cushion-plants, rosette-plants, mat-forming plants, and stiff-stemmed shrubs are greatly in evidence. Hairiness, leathery texture, and surprising rigidity, perhaps accompanied by needle-like points, as in the giant spaniards (*Aciphylla Colensoi*, *A. maxima*, &c.), are common characteristics of leaves.

There are many plant-communities composed of combinations of tussock-grasses, herbaceous plants, semi-woody plants, dwarf or creeping shrubs, and cushion-plants which are sometimes dense enough, and sometimes so open that there is more stony ground than vegetation. The most surprising community is that of unstable stony debris—the "shingle-slips" of the shepherds—which covers the slopes of certain dry mountains for some thousands of feet, particularly in Marlborough and Canterbury No less than 33 species occupy this inhospitable station, 25 of which are confined thereto. So far apart do the species grow—frequently many yards—that they bear no relation to each other. Their life-forms are clearly in harmony with the peculiar environment. All have thick fleshy or leathery leaves, frequently of the grey colour of the stones. In 16 species the part above the ground is annual; the shoots nearly always lie close to the stones, but if buried they have the faculty of growing upwards again. One species, *Cotula atrata*, has a jet-black flower-head, with stamens like tiny golden pin-heads.

Shrubland is common in the mountains, the most characteristic being the subalpine scrub, which on many mountains forms a dense belt above the timber-line. That typical of a wet climate consists of rigid or wiry-stemmed shrubs which grow into one another, and the main branches of many are parallel to the slope and project downwards. The scrub may be so dense that one must either crawl beneath it or walk on its treacherous roof. For the whole of the region the community consists of about 122 species, belong to 28 families and 49 genera. The chief groups of plants which compose the scrub are shrubby com-

posites and epacrids, wiry shrubs with densely entangled twigs (mainly species of *Coprosma*), species of *Hebe*, *Phormium Colensoi*, various podocarps, and giant spaniards. On river-terraces scrubs with species of *Hebe* dominant are frequent, and fringing stony river-beds there is often an open scrub of wild-irishman (*Discaria toumatou*)—one of the few spinous plants in the flora.

Rock-vegetation is always of interest, and this is particularly so in the high mountains. The number of species occurring on rocks is about 190 (families, 36; genera, 74). About 44 species are virtually confined to rocks, and such include a dwarf fern (*Polypodium pumilum*), certain rosette plants at present referred to the genus *Nasturtium*, one or two dwarf spaniards and a few forget-me-nots, hebes, celmisias, and raoulias

Outlying Groups of Islands.

The floras of the following groups of islands, far distant from the mainland, are distinctly part of that of New Zealand. The Kermadecs contain 117 species of ferns, fern-allies, and seed-plants, 16 of which are endemic, while 89 belong also to New Zealand proper. The largest island (Sunday Island) is covered with forest in which a variety of *Metrosideros collina*, a near relative of the pohutukawa, is the principal tree. The Chatham Islands possess at least 257 species, of which 36 are endemic, though several of the latter are trivial varieties merely, while the remainder of the flora is, with one exception, found on the mainland. Forest, moor, and heath are the principal plant communities. The leading tree is the karaka, but by the Moriori called kopi. On the moors are great thickets of a lovely purple-flowered shrub, *Olearia semidentata*. There are two remarkable endemic genera, *Coxella* and *Myosotidium*, the former belonging to the carrot family, and the latter a huge foget-me-not, now nearly extinct. The subantarctic islands (Snares, Auckland, Campbell, Antipodes, Macquarie) have a dense vegetation made up of 193 species, no fewer than 60 of which are endemic, the remainder being found in New Zealand, but chiefly in the mountains. Forest is found only on the Snares and the Aucklands, with a species of *Olearia* and the southern-rata as the dominant trees respectively. Extremely dense scrubs occur on the Auckland and Campbell Islands, and moor, sometimes with huge tussocks, is a characteristic feature of all the islands, thanks to the enormous peat deposits and the frequent rain. Several herbaceous plants of stately form (species of *Pleurophyllum*, *Anistome* *Stilbocarpa*, and *Celmisia*) and with flowers of extreme beauty—some of them purple in colour—occur in great profusion.

The Cook Islands, though a part of the Dominion, possess a Polynesian flora quite distinct from that of New Zealand, and are excluded from this notice, while, on the contrary the flora of the Macquarie Islands (belonging to Tasmania) is a portion of that of New Zealand.

Besides the indigenous, an important introduced element, consisting of about 630 species, mostly European, has followed in the wake of settlement. These aliens are in more or less active competition with the true natives. There is a widespread but quite erroneous

opinion that the latter are being eradicated in the struggle. This is not the case. Where the vegetation has never been disturbed by man there are *no* foreign plants, but where man, with his farming operations, stock, and burning, has brought about European conditions, then certainly the indigenous plants have frequently given way before artificial meadows and arable land, with their economic plants and accompanying weeds. But in many places associations not present in primitive New Zealand have appeared, owing to man's influence, composed principally, or altogether, of indigenous species. On the tussock-grassland invader and aboriginal have met, and though the original vegetation is changed there is no reason to consider the one class or the other as the conqueror. Finally, in course of time, a state of stability will be reached, and a new flora, composed partly of exotic plants and partly of those indigenous to the soil, will occupy the land, and, save in the national parks and scenic reserves, but only if these are kept strictly in their natural condition as to both plants and animals, this new flora will build up a vegetation different from that of primeval New Zealand.

NOTE.—The foregoing article is republished, with slight alterations, from the New Zealand Official Year-book, 1930.

TREES FOR SHELTER AND OTHER FARM PURPOSES.

THE following trees are recommended for planting in New Zealand, for shelter and other farm purposes, by the State Forest Service in its Circular No. 29 as under:—

CONIFERS.

Insignis Pine (Pinus radiata).—Of all pines grown in New Zealand this well-known tree has proved itself the most rapid growing, producing a heavy crop of timber in thirty years from planting. There should be a plantation of this valuable tree on every farm. Owing to its rapid growth and the dense shade thrown, it is recommended for planting to smother blackberry, gorse, and other noxious weeds. For this purpose the trees should be spaced 6 ft. apart in the rows and the same distance between rows, when 1,210 trees will be required to plant an acre. If planted in a single or double row, as a wind-break, the trees should be spaced 12 ft. or 16 ft. apart in the rows and 8 ft. between rows. Spaced at this distance the trees will retain their lower branches and form better shelter. For the production of timber the trees should be spaced 8 ft apart and the same distance between rows, 680 trees being required to plant an acre.

Macrocarpa (Cupressus macrocarpa).—This tree should be planted in soil conditions that will allow the development of a deep root-system On poor or very dry land the macrocarpa is short-lived, and tends to become "stag-headed," but wherever its roots can sink deeply a fine tree is assured Some of the finest specimens have been grown in

pure sand along the coast. It is a splendid shelter-tree and withstands salt winds, while the timber produced is moderately strong, very durable in contact with the ground, and provides excellent firewood. For shelter purposes best results are obtained from 12 ft. to 16 ft spacing, while trees grown 6 ft. apart with the same distance between rows produce good straight trunks, from which timber, easily split into fencing-material, will be obtained The use of trayed or boxed macrocarpa trees is strongly recommended in preference to open-rooted stock, which is difficult to successfully transplant. These plants can be lifted with a ball of earth from the trays, which greatly enhances the chance of a successful strike.

California Redwood (Sequoia sempervirens).—As its name implies, this species is a native of California, where in the mature forest it produces a very heavy stand of very durable timber of high use value. Redwood has made rapid growth in the North Island, and, although it cannot under these conditions be expected to produce timber of the same excellent qualities as when grown in its natural habitat, locally-grown redwood will certainly be of great value for numerous purposes where strength is not of paramount importance

Lawson's Cypress, or Port Orford Cedar (Cupressus Lawsoniana).—This hansome tree, from the Pacific States of North America, is recognized as one of the finest shelter-trees yet introduced into the Dominion, where, in light soils, it has done remarkably well. In the Waikato in particular Lawson's cypress has proved to be an ideal shelter-tree for the dairy-farm. Although comparatively slow-growing, it responds quickly to cultivation, while by the use of a little manure the growth may be increased. If the land on which the young trees are to be planted is ploughed, and a row of potatoes grown on each side of them, at least twice the growth, compared with those neglected in the grass, may be expected. Two-year-old transplants are recommended when planting this species, which produces a very durable timber, well and favourably known in the United States as Port Orford cedar.

Prickly-cone Pine (Pinus muricata).—This species is not quite so fast-growing as the insignis pine, but produces better shelter, and is recommended for planting in coastal districts subject to salt gales. It should be spaced as recommended for insignis pine, and two-year-old stock used for planting.

Bentham's Cypress (Cupressus lusitanica var. *Benthami)*.—A Mexican tree, similar in form to macrocarpa, but with a sage-green foliage and more graceful habit It provides splendid shelter, and is recommended for planting on clay soils where Lawson's cypress does not thrive so well. Two-year-old trees are recommended for planting.

Japanese Cedar (Cryptomeria japonica).—This native tree of Japan has proved hardy and has thrived in many parts of New Zealand, producing a fairly strong durable timber suitable for many purposes. It is an ornamental tree and should be spaced as recommended for insignis pine, and best results will be obtained from two-year-old transplants.

Douglas Fir, or Oregon Pine (Pseudo-tsuga Douglasii).—The natural habitat of this species extends from Cailfornia to British Columbia.

On the high, free soils of the centre of the North Island Douglas fir has proved to be moderately fast growing, but is unsuitable for the clay lands in the Auckland Province. In the South Island it is suitable only for use on foothills or moist districts. Does not succeed in hot, dry areas. This species transplants well, and should be planted as two-year-old stock.

Western Red Cedar (Thuya plicata).—In the State of Washington and in British Columbia this species grows to a huge size and produces vast quantities of light, coarse-grained durable timber. It has been only moderately successful in the North Island and when planted on dry soils tends to die when about twenty years old, but thrives better in moist situations. Two-year-old transplants should be used when planting.

Maritime Pine (Pinus pinaster).—This pine is a native of Europe, where it has been widely used in sand-dune reclamation. In certain parts of France, where it has been extensively planted for the same purpose, considerable revenue is derived from the resin and turpentine as well as from the timber. This species has not been as successful as the insignis pine and the prickly-cone pine, which afford better shelter, withstand the salt winds equally as well, and yield up to four times the timber produced by the maritime pine in the same period.

Lodgepole Pine (Pinus Murrayana).—A very hard tree, which should prove of great value for shelter purposes in high country. On account of the many stems springing low down on the trunk, this pine forms a windbreak of great density. The timber is usually small but of good quality.

Corsican Pine (Pinus Laricio).—As its name implies, this pine is a native of the Island of Corsica. It has been extensively planted in Europe, and has done better in New Zealand than has any other European conifer. In the colder regions of the South Island, where insignis pine will not endure the cold, this tree may be substituted. Since it requires about fifty years to produce merchantable timber, it is not recommended for extensive planting by farmers and others requiring timber or tree shelter in the shortest possible time.

Pondosa Pine, or Western Yellow-pine (Pinus ponderosa).—A native of the Pacific States, where it produces large quantities of good timber which is used for many purposes. The wood is stronger and harder than that of many other exotic pines grown in New Zealand, but, like the Corsican pine, requires at least fifty years to mature

EUCALYPTS.

In order to ascertain the most suitable species for cultivation of these valuable Australian hardwoods, the State Forest Service has been carrying out experiments for the last twenty-five years, and over one hundred species have been tested at Rotorua. Of this number it has been found that the species most suited to North Island conditions are those classified hereunder:—

E. Macarthuri.	*E. saligna.*	*E. fastigata.*
E. viminalis.	*E. eugenioides.*	*E. obliqua.*
E. Gunnii.	*E. Muelleriana.*	*E. regnans.*
E. botryoides.	*E. pilularis*	*E. delegatensis (gigantea).*

E. pilularis is one of the most valuable eucalypts yet successfully grown in the Dominion, but is suitable only for the warmer districts of Auckland, Hawke's Bay, and Taranaki.

One cord of well-dried eucalypt wood (*E. viminalis*) is equal in heating-value to about one ton of coal.

When temporary posts are required quickly it is best to space the trees 6 ft. apart in the rows and the same distance between rows. Planted at this distance 1,210 trees are required to plant an acre. After about ten years material which will last for several years may be obtained from the plantation, and the thinning-out process should be continued until the trees are spaced about 12 ft. apart, or 300 to the acre. These latter will produce the main crop, which will take about thirty years to mature. Eucalypts are probably the best trees for farmers to plant to produce a quick crop for fencing-material and fuel.

POPLARS.

Open-headed poplars as shade-trees for stock will be found useful, especially in wet places. As some are easily grown from cuttings, every farm should have an abundance of these trees as shade for stock during the summer months. Poplars may play an important part in the solution of the butter-box problem. The following species are recommended for planting: *Populus serotina*, *Populus fastigiata* (Lombardy poplar), *Populus eugenei* (a good timber-tree), *Populus nigra* (the black-poplar), *Populus regenerata* (a fast-growing variety), *Populus robusta* (a very vigorous tree).

BLACK-WATTLE (*Acacia decurrens* var. *mollis*).

In suitably mild districts this species of acacia will provide quick temporary shelter, fuel, and second-rate fencing-material; but, as it is susceptible to attack by the acacia gall-fungus, it is not recommended by the State Forest Service for extensive planting. Direct sowing of the seed on the site selected will give satisfactory results. Seed should be scalded or soaked before planting.

A WELL-PLANTED HOMESTEAD.

IMPORTATION OF FERTILIZERS IN 1929-30.

F. T. LEIGHTON, Analyst, Chemistry Section, Department of Agriculture

THE accompanying tables of statistics of artificial fertilizers imported into New Zealand during the year ended 31st March, 1930, have been compiled from data supplied by courtesy of the Comptroller of Customs.

The increasing appreciation of the value of phosphatic fertilizers is indicated in the returns, 346,000 tons of this class having been imported during the year under review. Since nearly half of this amount represents mineral phosphate imported for use in the manufacture of superphosphate it may be taken that the consumption of phosphatic fertilizers in New Zealand has now reached a figure well in excess of half a million tons per annum, comprising some 300,000 tons of superphosphate, 100,000 tons of basic slag, 100,000 tons of ground mineral phosphate and phosphatic guano, and not less than 20,000 tons of phosphatic animal-manure (mainly produced in the Dominion).

A marked feature of this year's importations is the increase in the amounts of North African phosphates. The bulk of the Moroccan phosphate brought into the Dominion has doubtless been utilized in the manufacture of superphosphate, but a certain amount is very finely ground locally and is sold in the raw state. The 37,000 tons recorded as North African phosphate (other) is practically all Tunisian (Gafsa) phosphate, ground in Belgium, whence it is imported into the Dominion.

The importations of basic slag are only some 1,100 tons in excess of those for 1928-29, in which year, however, the quantity of slag imported was nearly double that of any previous year. Some small shipments of 15 per cent slag have been placed on the local market, but it would appear that the New Zealand farmer is now accustomed to require a high-grade (17-20 per cent. or 20-22 per cent. phosphoric acid) basic slag of high citric-acid solubility, and that there is little demand for the lower grades These, though they may in many cases be equally efficacious in proportion to their phosphoric-acid content, suffer from the disadvantage of higher relative cost of transport (and thus greater cost to the farmer) per unit of phosphoric acid

Importations of French (Alsatian) potassic fertilizers have dropped nearly 50 per cent. from the previous year's figures, while the quantity of German fertilizers of this type has also declined somewhat. To the farmer accustomed to the finely crystalline Stassfurt products, the coarser, unevenly coloured Alsatian potash salts are not always attractive, and a number of samples have been sent to the Department's Chemical Laboratory for analysis, by purchasers who suspected their purity It may be said that, chemically, the Alsatian potash salts are in no way inferior to those more familiar products of Stassfurt.

Coming to nitrogenous fertilizers, it will be seen that a notable increase in the quantity of sulphate of ammonia imported has followed the interest aroused by the development in New Zealand of intensive methods of grassland management and the use of ammonium sulphate

in this connection. Importations of nitrate of soda also increased slightly, while small shipments of calcium cyanamide (nitrolim, lime-nitrogen) from Norway also arrived.

Under "Fertilizers unspecified" are included a total amount of 760 tons from Germany (see reference to German concentrated fertilizers in last year's notes—*Journal* for June, 1929, p. 404), and 500 tons (probably cyanamide) from Norway.

TABLE I.—SUMMARY OF FERTILIZER IMPORTATIONS, 1929–30 AND 1928–29.

Fertilizer.	Quantity		Declared Value	
	Year 1929–30.	Year 1928–29.	Year 1929–30.	Year 1928–29.
	Tons.	Tons.	£	£
Bonedust and bone-char ..	1,420	554	11,854	4,751
Basic slag	94,332	93,222	273,100	235,285
Superphosphate	525	1,037	1,309	2,557
Nauru-Ocean Islands phosphate ..	136,410	134,323	169,077	175,487
Island phosphate (other)* ..	34,587	43,734	46,390	66,810
Egyptian phosphate	300	6,000	1,024	18,975
Moroccan phosphate	35,348	22,173	49,090	32,667
North African phosphate (other) ..	37,424	12,499	94,020	29,856
Phosphate (not otherwise specified)	5,505	..	13,526	..
Kainit	839	880	2,270	2,800
Muriate of potash	28	36	188	397
Sulphate of potash	1,106	1,727	11,273	17,854
Potash salts (other)	6,217	10,786	31,178	50,288
Sulphate of ammonia	11,015	2,268	119,202	28,053
Nitrate of soda	2,263	1,780	22,442	18,968
Cyanamide	97	4	828	30
Sulphate of iron	63	72	469	510
Fertilizers unspecified	1,283	802	17,037	5,687
	368,762	331,897	864,367	691,071

* For details see Table 3 (next page).

NOTE.—The values shown in the above table are those declared for Customs purposes, and represent the current domestic values in the countries of exportation, plus 10 per cent.

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1920–30.

Year ended 31st March,	Bonedust.	Basic Slag.	Superphosphate.	Pacific and Indian Oceans Phosphate.	Egyptian Phosphate.	Moroccan Phosphate.	North African Phosphate (other).
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1920 ..	6,272	2,759	15,842	38,861	15,000	..	..
1921 ..	4,440	10,823	40,731	70,208	10,810	..	..
1922 ..	4,063	13,488	3,140	45,956	..	..	..
1923 ..	2,446	19,641	..	69,591	..	..	..
1924 ..	4,158	39,632	255	76,517	5,996	..	..
1925 ..	2,452	45,682	10	108,163	8,530	..	..
1926 ..	2,085	44,314	500	97,488	10,037	..	..
1927 ..	1,805	53,327	15	161,541	5,979	..	..
1928 ..	725	48,913	6,616	143,373	6,603	13,389	..
1929 ..	554	93,222	1,037	178,057	6,000	22,173	12,499
1930 ..	1,420	94,332	525	170,997	300	35,348	37,424

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR 1929–30, SHOWING COUNTRIES OF ORIGIN AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Australia.	Chile.	India.	Pacific and Indian Oceans Islands		United Kingdom.			Belgium.			France.			Germany.		United States of America.	Egypt.	Morocco.	Netherlands.
	Bonedust and Bone-char.	Nitrate of Soda.	Bonedust.	Island.	Phosphate.	Phosphate.	Sulphate of Ammonia.	Basic Slag.	Phosphate.	Basic Slag.	Potash.	Phosphate.	Basic Slag.	Potash.	Basic Slag.	Potash.	Sulphate of Ammonia.	Phosphate.	Phosphate.	Superphosphate.
				Nauru/Ocean	63,400															
Auckland	320	2,262	925	Seychelles	4,085	830	6,168	6,500	27,708	30,273	10	110		1,611	7,400	2,053	170		21,173	
				Makatea	4,071															
New Plymouth	.	.		Nauru/Ocean	10,807	125	1,025	1,930	932	21,198				260	575	630		.	1,715	
Wanganui	..		.	Walpole	1,696		.					..	..	.	..	.	..		2,000	
				Nauru/Ocean	17,572															
Wellington		.	50	.	.	575	670	1,995	1,870	6,200				200	1,230	202			50	.
Nelson			.	.			50	20	100	1,370	.	.		96		51		.		.
				Nauru/Ocean	28,150															
Lyttelton		.	.	Seychelles	1,340		851		815	270	.			328		229	220			.
				Makatea	3,256															
				Walpole	1,763															
Timaru	.	.	.	Walpole	1,216			.	861			.	.	80		20		.		.
Oamaru	.	..	.		.				150						.	10				
				Seychelles	3,619															
Dunedin	.	1	25	Nauru/Ocean	18,510	50	1,050	.	1,807	1,100				300	100	210	50	300	200	..
				Walpole	897															
Invercargill	100	.		Seychelles	10,199	3,715	755	100	3,181	1,590	30	.	75	1,025	150	813			2,151	500

SEASONAL NOTES.

THE FARM.

Pasture Management.

NORMALLY during June the grassland-farmer is busy carrying on important work which was commenced earlier in the season. If harrowing and top-dressing have not been completed then these two tasks will call for attention. Why and how these operations should be done has been indicated in a general way in the March and April notes.

On most farms there are certain paddocks which are more suitable than the others for providing late-winter and early-spring feed. A special point should be made of harrowing and top-dressing such paddocks in good time. Usually the paddocks which are suitable in this connection are those which are well drained and covered with a pasture containing a considerable amount of rye-grass, and possibly also are provided with some shelter. Young pastures recently sown, at times being soft, are prone to be unduly broken up, with harmful effects if used much for winter and spring grazing, and they should not be used more than is necessary for preventing the growth becoming detrimentally long. With such pastures the aim should be to obtain a happy balance in respect to severity of grazing—to prevent the growth becoming so long as to bring about undesirable shading of any species, particularly the more slowly establishing ones, and at the same time to graze not more closely than will serve to avoid the harmful shading effect, and in such a way as to minimize as much as possible "poaching" of the ground.

If a farm possesses pastures showing evidence of current infestation with grass-grub, then, when possible, hay and roots should be fed out on the infested areas; the additional stock-trampling and consolidation which results is not to the liking of the grubs, and the hay may contain viable seeds of valuable pasture species, which on germinating will tend to repair the ravages of the grubs and thus build up the pastures again.

It is not generally advisable to apply soon after each other lime in any of its forms and any of that group of phosphates which are chemically alike and which include raw rock phosphates, Island phosphates, and African phosphates. These phosphates are all relatively low in availability to crops and slow in their action, and become more markedly so when used on land which has received lime. Liming carried out in close time proximity to the application of basic slag may be expected to reduce the speed of action of the slag. When the question arises whether lime should be applied before phosphates or phosphates before lime in the same season, it may be taken as a general rule that it is preferable to do the liming first. But it is doubtful whether it matters much which material is applied first. From inquiries received it is clear that some farmers are inclined to look upon lime as a suitable substitute or alternative for phosphates. This is not the case; lime may at times serve to make phosphates more effective and profitable, but it will not fill the function of the phosphates.

In many districts pastures (particularly those containing a good deal of rye-grass) if shut up towards the end of May or early in June will provide a substantial amount of fresh grass towards the end of July and during August. The amount of July-August feed obtainable in this way can be increased by the use of nitrogenous manures on the grassland, but whether such use of nitrogenous manures will prove profitable depends on a number of circumstances which vary from farm to farm. For

instance, if a suitable pasture containing a good deal of rye-grass is available, the use of nitrogenous manure is more likely to prove profitable on it than on an old pasture containing little rye-grass. Again, if a farmer is faced with the likelihood of a shortage of winter feed the use of nitrogenous manure is apt to be of much more value to him than were he better supplied with winter feed

Value of planning Work ahead.

The planning of future farm operations may opportunely be considered at this time of the year, because the general lines of the work for next season should be decided upon at this stage There are several important matters to which thought might well be given. In the first place greater permanency is being imparted to our pasture management by top-dressing, and by the making available of superior strains of the most important pasture species such as perennial rye-grass. This greater permanency introduces new features to the special forage-crop position. Primarily it will reduce the amount of land it is desirable to put under the plough annually for the double purpose of providing special forage and of rejuvenating the grassland. Indirectly in many instances this will create a more urgent need than ever for greater yields to the acre in respect of such crops as mangels, turnips, and rape. In such instances there will be no decrease in the total tonnage of such crops which is required, but it will be desirable to grow that tonnage on a smaller area.

In general on high-priced land greater expenditure is justified than is usually realized, provided it results in appropriate crop-increase. This may be exemplified by considering the mangel crop. Available evidence suggests that there are more mangel areas which yield in the vicinity of 30 tons to the acre than there are areas which yield 60 tons to the acre. An expenditure of £4 10s. an acre on manure, seed, and cultivation may be necessary to secure a yield of 30 tons to the acre. If another £6 an acre is spent and a 60-ton crop secured, this would at first sight seem to be bad business, since the extra £6 expenditure produced only 30 extra tons, whereas the initial £4 10s. expenditure resulted in a yield of 30 tons. However, if a rental charge for the land of £6 is added, it is found that the 30-ton crop is costing 7s. a ton to produce, while the 60-ton crop is costing only 5s. 6d. a ton. The important point that this illustrates is that on high-priced land expenditures far above what are generally considered profitable—provided they lead to suitable crop-increase—really lessen the cost of crop-production. This point might well be kept in mind by many when planning the cropping programme for next season. To avoid all chance of misconception, it may be as well to state that the reverse rule at times applies in respect to land of low cost, and instances can be readily conceived in which the doubling of the crop-yield to the acre would be contrary to true farm economy.

In the planning of the cropping programme for the season 1930–31, another matter that might well be given consideration is the fact that the raising of high-yielding mangel, carrot, and lucerne crops is made easier and more profitable if these crops are given the advantage not only of high fertility, but also of freedom from weeds. Often relatively high fertility may be secured by breaking up old pasture for these crops; in any case nowadays the requisite fertility can always be provided, should it be naturally absent, by the use of suitable artificial fertilizers. Hence, because of the resort which may be made to manures, the natural fertility of the land sinks in importance, and the weed population of the land becomes a dominant consideration. Again, in respect to weeds, old pasture-land often exhibits superiority, provided it is handled properly. And this is so even though, as is sometimes the case, the surface layer is well populated with weeds and weed-seeds.

This matter is mentioned at the present time because farmers frequently are advised to begin the preparatory cultivation for these crops at about this season, and to carry out two deep ploughings during that preparatory cultivation in order to obtain the desirable deep and well-pulverized seed-bed. Because of this somewhat common advice it seems well to point out that from the weed viewpoint the two deep ploughings recommended constitute just one deep ploughing too many The first deep ploughing will put many weed-seeds at such depth in the soil that they will not germinate and hence will provide no trouble so long as they are left in that position. Why, therefore, bring them to the surface again? There is no good reason for doing this, provided a good seed-bed can be secured in some other fashion. Many find that the necessary good seed-bed can be obtained without two deep ploughings; the method they follow is to skim-plough and disk in the autumn, thus pulverizing the surface soil which contains the weeds and which later on is turned down deeply by one full ploughing and left there. This method may prove disastrous in the case of land infested with twitchy weeds, such as couch, sorrel, yarrow, and creeping-fog. But one really should not attempt to grow crops such as lucerne, carrots, and mangels on land infested with twitchy weeds.

In order to place all the weed-infested soil well underground it is at times of value to use on the plough a suitable skimmer attachment, thus lessening the weed-growth which often arises freely between the furrows. The use of a broad well-turned furrow materially helps in the complete and deep burial of surface weeds.

When the use is contemplated for forage-crop production of land which has been under the plough recently, then weeds again deserve consideration. Apart altogether from perennial twitchy weeds, the presence of considerable numbers of the seeds of spring-germinating annuals is most undesirable. Commonly occurring examples are spurrey (or yarr) and fat-hen in the South Island, and willow-weed and nightshade in the North Island. All means of minimizing weed troubles with forage crops require to be fully exploited. Many farmers have given up or are thinking of giving up forage-crop production. This is often chiefly because of labour considerations, and weeds beget labour difficulties. More forage-crop acreage would generally give increased gross production. Many farmers would do well to hesitate about dispensing with forage crops to any extent because of weeds until they have considered all promising means of combating the weed invaders. The point of particular interest is that available means of avoiding weed troubles are often not utilized simply because of lack of a little planning well ahead.

In many parts of New Zealand the supply of soil-moisture during the growth of the crop is apt to be the factor which limits the yield of heavy-yielding crops such is mangels, potatoes, and swedes. This fact constitutes a good reason why in the drier districts it is advisable to select the land for these crops in good time. Ploughing early enables rains, instead of running off the hard surface, to sink in and to be held in reserve for the use of the crop during its growth The importance of building up a moisture reserve in this way becomes obvious when definite cases are considered. During the growth of a mangel crop yielding 50 tons to the acre at least 2,000 tons of water per acre will have escaped from the soil through the leaves. Of course during the same period water would also have escaped from the soil by surface evaporation. The water lost through the crop-leaves alone is equivalent to 20 in. of rainfall. In many districts where mangels are grown successfully 20 in. of rain does not fall during the whole of the time the crop occupies the ground. Hence, unless substantial moisture reserves were built up prior to the sowing of the crop, one would have to be content with yields much below 50 tons to the

acre. Yet in these districts efficient farmers by commencing work in good time obtain yields up to and above 50 tons to the acre.

Crop Utilization.

It is not ordinarily desirable that stock be allowed to go down much in condition before a commencement is made with the feeding of reserves of such fodders as roots, hay, and ensilage It is all very well to count on the possibility of having to provide for a late, severe spring, but this looking to the future should not be carried too far at the expense of the current requirements of this stock.

The feeding-out of swedes on land which will be sown in turnips or swedes after a season or so should be avoided, if it is not, the land may readily be contaminated with the germs of such diseases as club-root and dry-rot, and these may attack badly the later crops which are subject to the same diseases. Fortunately, mangels and carrots are not likely to pass on crop-diseases in a similar way, and so care in this connection need not be taken in respect to them.

The winter feeding of stock on roots alone is undesirable, because stock so fed are called upon to live on a diet very unsuited to their needs. It is much too watery and cold for ordinary requirements, and is likely to set up digestive disturbances—all of which means waste. Roots may suitably be supplemented with dry fodder such as hay or chaff.

The value of ensilage as a winter feed for dairy cows has been fully established by its widespread successful use in this connection in previous seasons. The amount of good-quality ensilage that should be fed will depend to a considerable extent upon the amount of feed the stock are able to obtain in their grazing. Those who have had experience in the feeding-out of roots and hay may obtain some guidance from the fact that 1 lb. of grass ensilage equals in feeding-value approximately 2 lb. of roots, and that 2½ lb. of grass ensilage equals in feeding-value 1 lb of good average hay. The position should not arise in which animals will be called upon to maintain themselves on ensilage alone. Rather should the ensilage be used to supplement pasture in the ration, just as hay or root are ordinarily used in that way. In overseas trials ensilage has been fed with success to dairy cows in amounts ranging up to 40 lb. daily, but under New Zealand conditions it should seldom be necessary to attempt to feed so much, for usually smaller quantities will be sufficient to supplement the feed provided by the pastures.

Ensilage has been fed with good results to sheep when used as a supplement in the ration at the rate of about 2 lb. daily. Our experience is too limited to enable us to say what is the maximum amount which can be fed daily to sheep

On many farms the pulling and storing of mangels should now receive attention, particularly if the land occupied by the crop is required for another crop such as oats. It is not easy or safe to lay down any rules about the pulling of mangels. In certain districts the crops will continue growing in weight well beyond the date fixed by some as that at which pulling should have been carried out. It is very doubtful whether it is advisable to pull such growing crops early in June if they are not required for use until late in August or September, unless the land they occupy is especially required for some other crop or likely to become so wet later that it will be very difficult to cart the crop off it However, if the crop is to be fed to stock earlier than has been mentioned, then it should be pulled in good time to allow it to ripen or mature before the stock consume it. Freshly pulled mangels cannot stand frost as well as those still in the ground or that have been pulled for a few days. Hence, if at all possible, in order to avoid frost injury broken mild weather should be selected for

the work of pulling. Many sheep-farmers are successfully utilizing mangels later on in the season without storing them. If broken-mouthed ewes are available they are put in to eat off the tops then the roots are harrowed out in breaks some days prior to the sheep being given access to them

Tillage Operations.

Where the soil is not too wet and cold oats, barley, or rye-corn may often be sown with success in June to provide useful spring feed. Such crops should not be drilled deeply, and they will respond profitably to a dressing of from 1½ cwt to 2 cwt. of superphosphate an acre. Disease-control measures by seed treatment should be carried out as with earlier-sown cereal crops.

The team or tractor should be kept at work as much as possible preparing land for spring sowings of cereal and root crops. Often when land which was recently under the plough is too wet to work without harm, lea land which is being broken up can quite well be worked.

—*R. P. Connell, M.A., Fields Division, Palmerston North.*

THE ORCHARD.

After-harvest Work.

WITH the rush of harvesting, packing, and marketing finished, numerous odd jobs in the sheds and orchards will present themselves, and the difficulty will be in deciding the order of priority. Pruning, planting, and ploughing can all be proceeded with, and a general clean-up of the shed, overhaul of plant and orchard cases, and the destruction of rejected diseased fruit will be necessary to restore the desirable orderly condition. Any inside work will doubtless be deferred for a wet day, and outside operations expedited while favourable conditions prevail.

Autumn ploughing on bare land will take precedence while the soil is comparatively dry, particularly on heavy land where working in a wet condition produces a furrow of dough-like consistency which remains tight and compacted and impervious to the ameliorating influence of frost or sunshine. On hillsides where excessive scouring is likely to occur it is advisable to plough obliquely across the face of the hill to lessen the rate of flow, but where the water is diverted into depressions provision must be made for its escape, or injury to the roots and possibly the death of the trees will result.

Planting.

Young trees may be planted as soon as the soil becomes sufficiently moist. Under favourable conditions—and good results cannot be expected if conditions are not favourable—autumn planting is preferable to spring planting, but it is essential that the soil should be dry enough to work without forming a puddle when trodden or dug over. The production of root will commence in advance of any visible action in the top, and disturbing the tree for spring planting is liable to destroy the rootlets and delay its establishment, with serious detrimental results in the event of an early cessation of damp weather.

Apart from late planting, the most common cause of failure is planting too deeply. Under this condition trees assume something of a starved appearance, starting into growth each season, but failing to produce a reasonable amount of young wood, eventually dying back gradually from the tips and providing a good illustration of the general symptoms of root trouble. The correct depth to plant can generally be gauged by examination of the stem, the junction of the smooth slightly blanched

portion with the harder dark bark indicating the previous ground-level, which should not be varied, or, with a few exceptions such as some of the nuts and occasionally in seedling pear stocks where the underground portion of the trunk is thickened, the formation of root commences about a couple of inches below the surface, and replanting to about that depth should be approximately correct.

A little extra work in preparing the holes is well worth while, and the object should be to provide conditions which will stimulate root-action in all directions, so as to ensure a good anchorage and rapid growth. Having dug the hole, the bottom soil should be replaced with nice surface soil in which two or three handfuls of blood and bone has been mixed, and mounded slightly in the centre, so that when the filling is replaced the roots will have a downward tendency. The hole should be dug to accommodate the roots with some room to spare without bending them to make them fit the hole, for the future security of the tree is dependent upon an even distribution of the roots providing a stay in each direction. Any damaged roots or dried-out ends should be removed immediately before planting, and as a protection against sun and wind and possible dry soil conditions, it is advisable to dip in a puddle of soil and water. In covering the roots only friable fine soil should be used, and when the hole is nearly filled it should be well trodden to firm the tree and exclude air-pockets, then completing the filling, leaving the top soil loose. The tree should be heavily pruned to compensate for the loss of root and to form the foundation of the framework.

Manuring.

The application of slow-acting manures should be proceeded with, in order that the chemical changes may proceed and the plant-food be made available for the trees when they are ready to commence growth in the spring Quantities will be governed by the condition of the trees and the soil type, but to maintain quality and average production the available supplies of phosphates, nitrates, and potash should be commensurate with the trees' requirements. Nitrate of soda as a stimulant to lagging growth should be applied as growth commences. Periodic dressings of lime are necessary to obtain full value from the manures and improve the soil-texture.

Pruning.

Pruning may be started as the growth ripens, commencing with stone-fruits and following with the pomes. In practice there are so many deviations from all well-defined systems—rendered necessary by varietal peculiarities, physical condition of the tree, age, &c.—that any definite directions are apt to be misleading; but broadly the general principles apply throughout, and by noting the fruiting habit of the tree and its response to previous prunings any modification necessary can be made on well-defined lines. Briefly the objects of pruning are: To build up and maintain a physically strong tree of a size and shape best suited for convenience and economy in management; to maintain the balance between wood and fruit production, and ensure an annual average production of fruit of even size and quality; to regulate or modify the growth, in order to obtain an even distribution of the fruiting-wood throughout the tree.

In orchard practice pruning must be accompanied by cultivation and manuring to maintain vigour, and spraying to control diseases which retard or destroy growth. Although cultivation at times can be suspended with advantage as a means towards reducing wood-production and promoting fruitfulness, neglected cultivation or manuring, especially in peaches or nectarines, may produce a condition of stagnation which renders satisfactory pruning almost impossible. Just as growth is essential to satisfactory pruning, so is pruning essential to satisfactory growth, inasmuch

as the tree's efforts are directed towards smothering any possible contender for a place in the sun, and in so doing developing its highest points to the detriment of those less favourably situated, until from an economic point of view the tree is of little value.

To counteract this tendency a limited number of well-placed limbs are selected, and by annual pruning wood-production is encouraged with a view to developing fruit under the most advantageous conditions. One of the essentials to quality fruit is the free access of ample light to all portions, and to this end the removal of any growth crowding the centre or causing dense places in the outer fringe claims first consideration. In this connection it is necessary to bear in mind that comparatively upright growths during the winter will approximate the horizontal under the weight of a crop of fruit, and allowance should be made to avoid overexposure.

Dealing in particular with peaches and nectarines, where the fruit is borne on growth produced the previous season, provision for ample renewal of wood is necessary. Left to its own devices the tree will make more wood than is desirable, and each season the fruiting-area will get farther out of reach and many of the light twiggy growths will die out Various methods of treating the young growth are practised, but the general principle in each is to remove at their bases about half of the one-year laterals, cutting the weedy ones and leaving alternate strong ones for the next season's fruiting. From the basal buds of those which were removed, young shoots should arise during the next growing season for the following season's fruiting. By shortening the shoots which have borne fruit and thinning the young ones provision is made for a continuous supply of fruiting-wood and much of the labour of thinning the crop is avoided Any shortening of limbs is done by cutting back to a suitable lateral with an outward tendency. Excepting varieties which habitually set the bulk of the crop towards the base of the laterals or evenly throughout their length, any shortening of laterals is not desirable, as with tip-bearers the crop may be severely reduced.

Apricots In some districts the prevalence of silver-leaf (silver-blight) is making growers chary of pruning apricots, but unless heavy and continuous manuring is followed to maintain vigour the fruit must deteriorate in size and quality, and the probability of the disease gaining entry through accidental breaks in the unwieldy limbs discounts any possible benefit. In suitable localities apricots are vigorous growers, and liberal pruning is necessary to keep the trees within bounds. A dense head should be avoided if the fruiting-brush is to be retained on the lower portion of the tree. The fruit is produced on comparatively short-lived spurs and on the previous season's growth, necessitating a system of constant renewals. Shortening the one-year wood will promote the formation of spurs and shoots of varying strengths, some of which will be retained for fruiting and the remainder eliminated to avoid overcrowding. Frequent duplication of the leaders should be avoided, and any promising shoots on the main limbs encouraged by shortening. Some judgment is required in determining at what length the young wood should be cut, for it left too long the lower buds will not break, and if too short an excess of strong shoots detrimental to fruit-production will result.

Citrus Culture.

Conditions favouring the development of citrus brown-rot will still prevail, and the 4–4–40 bordeaux must be maintained, particular attention being given to the lower parts of the tree to prevent the upward progress of the disease. Prompt and regular harvesting should be attended to, so as to prevent ripening proceeding beyond the silver or pale-yellow colour best suited for curing. Sweet oranges should be allowed to properly mature before picking, in order to obtain full flavour ; with greater discrimination

in selecting only well-ripened fruit much of the prejudice against locally grown oranges should be overcome Poorman oranges for table use should be harvested while the flesh is tight and compact, so as to secure the maximum juice content.

Trees for new plantations should be secured as early as possible, and if conditions are not suitable for planting they should be laid-in until required It will be found more satisfactory to obtain supplies early in the season, while stocks are large, than later when the stock is depleted. In frost-free localities planting may proceed when soil conditions permit, but where there is any danger of frost it is advisable to defer planting until the spring. Wherever possible trees with a single stem should be selected, and, although it may appear drastic, trimming to prevent branching for at least 2 ft. from the ground will be a benefit in future years. Lemons will not thrive under waterlogged conditions, but good results can be obtained in low-lying ground by throwing up a mound about 6 ft. across and planting on the top. Mulching in the summer may be necessary under these conditions, but better growth is assured. Unprofitable varieties or trees of poor type may now be headed back to stimulate the production of young growth suitable for budding next season.

—*G. H. McIndoe, Orchard Instructor, Gisborne*

POULTRY-KEEPING.

Preparations for the Ensuing Breeding-season.

THE necessity for not neglecting any detail that will ensure having the breeding-stock and the hatching and rearing appliances in the best possible condition for the forthcoming breeding - season cannot be too strongly emphasized.

Where it is intended to commence hatching early in July—which is a good time for bringing out pullets for the production of eggs in autumn, when egg-prices have a rising tendency—the breeding-pens should be mated up with as little delay as possible. It is a mistake to leave the mating until just before eggs are required for hatching purposes The birds should be given an opportunity to settle down and become accustomed to their new surroundings. Especially does this apply to birds taken from a free range and placed in confined quarters In such cases they will usually fret, and it cannot be expected that eggs containing strong germs will be produced by birds in this condition. Another advantage in early mating is that the eggs can be tested for their fertility before being actually required for reproductive purposes. It sometimes happens that a vigorous male bird will exhaust itself at the outset and it will be some weeks before satisfactory fertility is obtained. This may cause the postponement of the hatching-period, probably through inability to secure a fresh male. It is always a wise policy to have a spare male at hand as a standby.

Poultry-keepers who have acted in accordance with the advice given previously in the *Journal* will have selected and specially marked the best breeding specimens during the late autumn, or at some time before the birds moulted. It is at that period of the year that certain signs whereby the good layer can be distinguished from the poor one manifest themselves in a striking manner. If nothing is known about the laying ancestry of a fowl she assuredly must be judged on her own performance, and there is no better rough guide to performance than the time at which she moults and the extent of that moult The bird which holds out longest—the most persistent layer—is the bird that carries away the chief honours at the egg-laying competitions. In other words, the first

bird to moult is too often the last bird on the list when the year's yields come to be published, and the experience of the egg-laying competitions is being repeated on private plants all over the country. Obviously when the choosing of the breeding females has been left till now, when the flock has moulted and all the birds are in a similar condition so far as their plumage is concerned, it is impossible to distinguish between the early and late moulter, except of course when they have been specially marked to indicate this point. The poultry-keeper who has neglected to select his late moulters may expect a high proportion of unprofitable stock as a consequence.

Mating and Constitutional Vigour.

In recent issues of the *Journal* much advice has been published as to the points to be looked for when selecting a good breeding specimen, and these need not be repeated here, except to say that when the final selection is being made the greatest care should be exercised to ensure that no bird of either sex is placed in the breeding-pen unless it possesses the desired vigour. It should be remembered that in a natural state constitution is effectively maintained, the strongest male selecting the best breeding female by force. With the advance of civilization, and man's interference with the breeding of animals which he has domesticated, natural selection is rendered more or less impossible.

The history of the domesticated fowl is a striking instance of this. With the natural process of selection rendered impossible, we have improved the egg-yielding capacity to such an extent that exceptional stamina is demanded if the modern layer is to continue its great artificially induced production without bringing about its own deterioration. The fact cannot be too strongly emphasized that the greater demand we make on a fowl as regards egg-yield the greater the care we must exercise in seeing that her vigour is not impaired in the process; while we must take every means to ensure that she has all possible care and attention, particularly in the housing and feeding.

Disease, particularly intestinal parasitic infestation, is what the poultry-keeper has most to fear, and we know that the more we remove the animal from natural conditions of life and production the greater the tendency to troubles of this sort. The only way of fighting them is by never allowing the constitution to deteriorate, housing the birds in airy but draught-proof roomy quarters, and feeding them liberally. The more artificial the animal the greater the care demanded by the owner, and there is probably no domesticated animal of a more artificial type than the New-Zealand-bred heavy-egg-producing White Leghorn. Thus, even where the late moulters are concerned, every bird should be carefully examined in order to ensure that it is healthy and possesses constitutional vigour before being admitted to the breeding-pen. No matter what other good points are possessed, whether it be male or female, if there is the slightest constitutional taint the bird should be rejected as a breeding specimen.

Brooders and Incubators.

As already indicated, a matter that should be now attended to is over-hauling the incubator and brooder appliances. Everything should be done to rectify anticipated trouble, such as providing fresh burners for lamps for those that are worn out and unreliable, replacing connecting-rods for the incubators where the old ones have become bent, or new thermometers for those which have become broken. It is also a good plan to always have a good store of lamp-wicks of the correct sizes to fit the lamp-burners. It frequently happens that duplicate parts of incubators

and brooders are difficult to secure, especially with imported appliances. Failure to attend to these little details now may cause endless worry and loss of time at a later date.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Care of Hives.

At no other season is the welfare of the colonies of such importance as during the next few months. Every hive should be raised from the ground to the height of one brick, and if the situation is damp or low-lying it is a good plan to raise the hives still more This will tend to keep them free from slaters (wood-lice) and other insects, and will afford less harbour for mice, as well as ensuring a free current of air beneath the bottom-boards, which are thus more likely to keep dry The bottom-boards should never be rested on the ground, or they will rot in a very short time and become mouldy and evil-smelling.

Before bad weather sets in it is a good plan to give a coat of paint wherever it is needed, at the same time stopping up all cracks in the supers. Cracks afford ventilation during the summer months, but they are hardly to be advocated on that account, because the beekeeper will usually find that towards the end of the honey-flow the bees will use much valuable time in gathering propolis to paste up the cracks in view of the approach of winter. The hives should be slightly canted forward, so that any rain which falls on them will drain off the alighting-board.

Apart from disease, there is no worse feature in an apiary than the presence of leaky hive-covers. A roof which allows moisture to trickle through is a constant menace to the colony it appears to shelter. Not only will the mats immediately beneath it become sodden and mouldy, but the cluster of bees in the hive stands in danger of extermination when frost sets in. There will then be pollution unspeakable on the bottom-board, where the intruding moisture mixing with dead bees and waste pollen forms a rotten fermenting mass, with a stench which the order-loving bees must find more obnoxious than does their owner. There is no excuse for leaky covers. In the autumn the apiarist should examine them for any doubtful spots, and should cover them with either zinc, ruberoid, or some other waterproof material If economy must be practised he may cover with cheesecloth, applying to the roof first a coat of paint, then the cheesecloth, and then another coat of paint. This makes an effective waterproofing, and one which anybody can apply.

Removing Spare Supers.

As advised last month, all top boxes not actually occupied should be removed and the bees made as snug as possible. If the colonies have been well cared for, and are headed by good queens, they will need at least one top box in addition to the brood-chamber, which will be fairly crowded with young bees bred since the close of the main honey-flow. These are colonies that the beekeeper should strive to have, as they will come out strong in the spring and give the best returns when the next season's honey-flow arrives. In removing supers at this time every care must be exercised to avoid robbing. There will be bees in the supers to be removed, and these can be got rid of by using bee-escapes. By putting these on in the evening the supers will be clear of bees in the morning, providing there is no brood in the combs. All operations at this period should be carried out as expeditiously as possible so as not to attract robber bees, which are much in evidence during the warm hours of the autumn days.

The Annual Conference.

The 1930 conference of the National Beekeepers' Association is to be held at Auckland on 15th, 16th, and 17th July. The conference has been arranged to coincide with the winter show in Auckland Delegates from all parts of the Dominion will be present, and lectures and demonstrations by leading commercial beekeepers will be given.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Pruning and Manuring of Bush Fruits.

THE crop produced from areas planted in bush fruits is very commonly low in quality and quantity, owing to the neglect of suitable pruning and manuring. The bushes then become crowded with stunted growth, and the fruit is small and tiresome to gather. Most plantations of this class may be brought back into good bearing condition by careful attention now to pruning and manuring.

The black-currant bushes especially should have a number of the older growths cut low to encourage the production of strong fresh wood, as it is on growth of that kind the best fruit is borne during the following season. By means of this simple treatment now, and generous manuring, most plantations would produce larger crops and a better sample of these popular berries.

Gooseberry-bushes are usually far too crowded with growth for maximum cropping, which can only be obtained by opening up the plant to admit light and air In such cases the crowded framework should first be thinned out well, and all suckers and strong water-shoots about the centre of the bushes removed entirely. When this is done weak young laterals and those that cropped last season should be cut back to the buds at the base. This leaves the strong young wood well spaced for cropping during the coming season From these young growths the unripened tips should be removed. This may be rather a heavy task, but if it is followed up annually the bushes soon assume a thrifty habit that makes the work much lighter.

Red and white currants are now in better demand. The former especially is in great request for jellies and mixing with other fruits to give preserves colour. Instead of producing the fruit on young wood, as in the case with the black currant, they bear the crop on spurs on the older wood. For this reason suckers should be entirely suppressed, and the leading growth should be only lightly shortened, if at all, in established bushes. Contrary to the black variety, again, the centres must be kept open to admit light and air, the stronger superfluous laterals being removed completely. The lighter laterals may be shortened with a view to the formation of fruit spurs, although this is often best done in summer as a check to the overvigorous growth to which these plants are liable. It is unusual to see these bushes correctly treated, but where it is done the results form a striking contrast.

When the pruning is completed, and the trimmings removed and burnt, these and similar plantations of small-fruits should be given a good dressing of fowl or other manure. This should be in a friable, fermented state and well harrowed in. If the land is deep and rich and ploughing has been usually done it may be turned under in that way, but the fibrous roots of such plants are usually very near the surface, and often it will be advisable to work the manure in with a cultivator.

For the first two or three years after laying down new plantations of bush fruits one is chiefly concerned in pruning the plants to induce plenty of vigorous growth that is well spaced out, and which may be suitable for the formation of a permanent frame. For such reasons as this new plantations of raspberry-canes should be cut down to a height of 6 in. from the surface of the ground, and young gooseberry-bushes should have two or three of the strongest shoots selected and shortened to side buds to form the base of the main framework of the plant In doing this it is convenient to have plenty of shoots from which to make a selection, but one must avoid the temptation to leave in too many, as such action will lead to the bush becoming crowded with growth, and thinning is then a big undertaking and delays the development of the plants.

There is room in the alleys of such young plantations to grow a vegetable crop of a shallow-rooting character for the first season If the land is properly prepared—that is, clean and richly manured—there is no need to miss a crop, so long as the bushes are protected from encroachment.

Preparing for Tomatoes and Cucumbers under Glass.

Those who are growing tomatoes and cucumbers under glass will now be busy preparing to commence a new season. Sterilizing soil for seed-boxes, making up hot-beds cleaning down or fumigating the interior of glasshouses (where this has not yet been done satisfactorily), and trenching or digging the land under glass, and generally preparing it for planting at the end of the month of July or August, are the opening items of a busy programme of production

Sufficient fresh stable manure for making hot-beds is often unobtainable, and it is then advisable to carefully conserve any supplies of fallen leaves from deciduous trees that may be available in the vicinity. Mixed with the stable manure they serve the purpose admirably: in fact, satisfactory hot-beds may be made with leaves alone when they are properly fermenting.

In a new glasshouse the first crop or two is phenomenally successful in most cases, and a pleasing confidence is established, which, however, is often rudely upset in the course of time by the attack of diseases and pests. The manager of glasshouses has to be continually on his guard, and the best opportunity which offers for defeating these attacks is when the house is empty. The inside may then be well sprayed down with 1 per cent. or 2 per cent. of a formalin solution if mildew, moulds, or other fungous diseases have been prevalent during the past season, and even the soil saturated and covered with sacks for two or three days to retain the effective gases which are liberated. If insect pests have been troublesome a good contact insecticide or fumigant will best meet the case.

The brickwork in cucumber-houses should be swept down with a hard brush and given a coat of hot limewash. A little cement added will make it stick better, and a handful or two of flowers of sulphur or a small quantity of kerosene stirred in a pail of wash will increase its cleansing properties.

The Market-garden.

The very common practice of allowing land to remain undisturbed after a crop is removed, and deferring its preparation until shortly before it is to be planted again, is very unsatisfactory management. Under such circumstances pests in the ground thrive, and the opportunity for slow-acting manures to become effective before planting is lost as also is the opportunity of growing a hardy green crop for turning in. By ploughing the ground as soon as the crop is removed, and leaving it rough, many pests are destroyed by the disturbance, and birds have an opportunity of feeding on the noxious larvæ. Lime, basic slag, bonedust, or kainit

are useful alternative dressings that can often be used with great advantage, and these with organic manures turned in now have time to become assimilated, so that the ground is in good heart when it is further broken down and cultivated just before the spring planting. Under such treatment slugs, snails, wireworms, and cutworms are destroyed easily, and the loss of young plants in the springtime is most readily avoided Those who have light land by the seashore cannot do better than use what supplies of seaweed are available. Such manures are equal in cultural value to that from the farmyard, and are specially suitable for sandy ground if ploughed under now.

Seed potatoes should be given light and air to prevent them sprouting Where the quantities are large and in sacks, they may be turned occasionally, but stacking should be avoided ; as an alternative the stocks may be stored in slatted cases in an airy place Where seed has to be bought it should be obtained without delay, as there is considerable competition for good seed, and the important matter of careful storage can be ensured At one time it was most difficult to obtain pure lines of sound seed, but the Government system of potato-seed certification is gradually improving the supply, and seed true to name and free from the mysterious virus diseases that have caused such serious loss in the past may now be obtained

Lettuce and other plants growing in frames in preparation for planting out next month should receive careful attention. Leaking sashlights and a close atmosphere create conditions that quickly infect the plants with fungous disease, which develops often only after the plants are set out. By keeping the plants on the dry side and giving plenty of air on every suitable opportunity they may be kept strong and hardy, and most of the losses from rust and sclerotinia will be avoided.

The Home Garden.

Bare patches on lawns may now be repaired by neatly inlaying suitable fresh turf. Depressions can be levelled up by peeling back the turf and filling up with good soil made firm and the turf replaced. Similarly, sections that are too high may be lowered by removing the soil. The improvement of lawns and grass verges is very great where such attention is given now.

Most shrubberies and plantations would also be improved by suitable thinning and pruning Fine specimens are often injured by the crowding of less valuable plants ; the latter should be removed, or at any rate pruned well back. Conifers with double leaders, and trees and shrubs with crowded and crossing limbs, should have such superfluous growth entirely removed as well as all dead wood. Besides the greatly improved appearance, they are less likely to be damaged by winds, and the plants are greatly invigorated. Laurel, taupata, and similar hedges are frequently found with crowded overhanging tops and a weak open base. To make such hedges presentable the face should be cut vertically—in fact, the top should be rather narrower than the base. The lower portions of the hedge will then improve greatly from the increased light and nourishment received.

On the other hand, while a good thick hedge is always admired, the growth sometimes becomes too tightly interlaced. In such instances some thinning with the secateurs will often strengthen and deepen the foliage on the face and much improve its appearance. As such hedge-pruning causes some disfigurements until new growth takes place it is usually deferred until the end of August or beginning of September, when new growth takes place almost immediately. Carefully considered treatment along these lines produces a handsome hedge that is very ornamental, and produces that well-kept appearance which is creditable to garden management.

—*W. C. Hyde, Horticulturist, Wellington.*

CERTIFICATION OF SEED POTATOES.

PROVISIONAL CERTIFICATES ISSUED FOR SEASON 1929–30.

A LIST of growers who have received provisional certificates in connection with the official certification of seed potatoes in the past season is printed below.

Provisional certificates are issued with the object of affording growers some indication of the general standard of their crops and assisting them in the disposal of their seed Certificates and certification tags are issued later, provided that an officer of the Department of Agriculture inspects the graded seed potatoes, and is satisfied that they are still of the same standard in regard to purity and freedom from disease as was indicated by the field inspections.

It will be noted that this year the cropping-power of each line is also published. The cropping-power has been determined by means of trial plots undertaken by the Department, and is calculated by adding together the yield of table tubers and half the yield of seed-size tubers. Differences of 1½ tons per acre or more may be regarded as definite differences in cropping-power. Differences of 1 ton per acre, while not significant, may be taken as an indication that there is some slight difference. Differences of ½ ton per acre cannot be regarded as reliable differences.

LIST OF GROWERS.

Growers and Varieties	Cropping-power in Tons per Acre	Acreage.
Aucklander Short-top (N Z Sutton's Supreme) —		
Canterbury Seed Co , Leeston (line B)	14·0	2
D Marshall, R.M D , Killinchy	10·0	5
J Jellie, Russley Road, Fendalton (line A) ..	10·0	3½
W. E. Martin, R.M D , Kaiapoi	10·0	6
R Barnett, Dunsandel	9·5	5
Canterbury Seed Co., Leeston (line A)	9·5	2
Muff Bros., Orari	9·5	4
T. O'Brien, St. Andrews	9·5	1
A. D Carroll, R.M.D , Southbridge	9·0	4
Weeber Bros., Englefield Road, Belfast (line A) .	8·5	2½
A. J. Rich, R.M.D., Kaiapoi (line B)	8·5	5½
C. Redmond, Kimberley	8·5	6
J Jellie, Russley Road, Fendalton (line B) ..	8·0	6
M. Breen, Levels	8·0	4
F Brundell, Camside, Kaiapoi	8·0	5
A. J. Rich, R M D., Kaiapoi (line A)	7·5	5½
W. Oakley, Halkett	7·5	1
E. A. Smith, Lincoln	7·5	5
Weeber Bros , Englefield Road, Belfast (line B)	7·5	4
L Seyb, Washdyke, Timaru	7·5	1
G. Gudex, Washdyke, Timaru	7·5	1
J. Rouse, Pareora, Timaru	7 5	2
F. C. Herridge, Woodend	7·5	1
C. H. Jordan, R.M D., Kaiapoi	7·5	5½
G. Harris, Orakipaoa, Temuka	7·5	3
E. H. Daniel, Kingsdown, Timaru (line B) ..	7·5	6
Aucklander Tall-top (N Z. Sutton's Supreme) :—		
H. S. Moore, Box 4, Kaiapoi	14·0	15
M. S. Kelly, 502 Lincoln Road, Halswell ..	11·5	1
J. Warren, Russley Road, Fendalton	10·5	12
G Jones, "Vale Royal," Halswell	10·5	1

LIST OF GROWERS—*continued.*

Growers and Varieties.	Cropping-power in Tons per Acre	Acreage.
Aucklander Tall-top (N.Z Sutton's Supreme)—contd.		
J. Bailey, R.M.D., Kaiapoi	10·0	8
Weeber Bros., Englefield Road, Belfast.	9·0	6
J. D. McMullan, Elmwood, Kaiapoi	8·0	10
L. Seyb, Washdyke, Timaru	8·0	3
Dakota.—		
C. E. Walker, R M D., West Melton	11·5	5
W. J Crozier, Mitcham, Rakaia (line A)	10·5	2
M S. Kelly, 502 Lincoln Road, Halswell	10·5	2
Munro & Scarth, Rokeby, Rakaia	10·0	2
F. McNae, R M D, Courtenay	9·5	1
W Gee, Springlands, Blenheim	9·5	1½
T. Small, Mitcham, Rakaia	9·5	3
S Cross, R M.D, Rolleston (line B)	9·5	9
W. J Crozier, Mitcham, Rakaia (line C)	9·0	2
W A. McPhail, Mitcham, Rakaia	9·0	20
S. Cross, R M D, Rolleston (line A)	9·0	16
A J Breakwell, Tinwald, Ashburton (line C)	9·0	7
E Hinton, Templeton	8·5	4½
L. Seyb, Washdyke, Timaru (line A)	8·5	-
G. Gudex, Washdyke, Timaru	8·5	1
P. J. Thornton, Harewood Road, Papanui	8·5	4
J. Curragh, Templeton	8·5	1
P. J Gill, Box 11, Kirwee (line A)	8·5	2½
W J Crozier, Mitcham, Rakaia (line B)	8·0	2
S. Tweedy, Dunsandel	8·0	5
R. Hewson, Seadown, Timaru	8·0	4½
S. Palmer, Burnside Road, Fendalton	8·0	2
J. Argyle, Allenton, Ashburton	7·5	2
J. H. Doak, Barr Hill, Rakaia	7·5	13
R. McDonald, Waikuku	7·0	8
Jas. Carr, Highbank, Methven	7·0	8
H M. Marshall, R M D, Weedons	7·0	2
Arran Chief.—		
C E Knowler, Tuatapere	10·5	2
A. C. Townshend, Woodstock, Darfield	7·0	2
G. Jones, "Vale Royal," Halswell	6·5	1½
Bresee's Prolific.—		
F. W. Carpenter, Prebbleton	6·5	17
Jas. Carr, Highbank, Methven	6·5	8
D Marshall, R M D., Killinchy	5·5	27
W Chappell, R M D., Killinchy	5·5	2
L. Seyb, Washdyke, Timaru	5·0	2
G. Pierce, R.M D., Killinchy	5·0	8
A. Allen, R.M.D., Killinchy	5·0	14
King Edward:—		
A. Anderson, Stirling (line B)	8·5	1½
A. H. Rose, Glencoe, R M.D., Invercargill	8·0	1¼
L King, Glencoe, R.M.D., Invercargill	8·0	2
W. E Brown, Orepuki	8·0	1½
C. E. Knowler, Tuatapere	7·5	2½
J. McLeary, Mataura Island	7·5	2½
A. A. Jensen, Stirling	7·0	3
O. S. Mosley, Stirling	7·0	7
R. M. King, Tuatapere	7·0	3½
Up-to-date:—		
C. E. Walker, R.M.D., West Melton	11·5	2
H. D. Norman, Tuatapere	8·0	1

LIST OF GROWERS—*continued*.

Growers and Varieties	Cropping-power in Tons per Acre.	Acreage.
Northern Star :—		
J. T. Brown, Pahia	9·0	1
Epicure :—		
G. McLachlan, R.M.D., Southbridge	9·5	11
W. Shellock, R.M.D., Mead, Rakaia	7·5	4
D. Marshall, R.M.D., Killinchy	7·0	10
L. T. Wright, Annat	4·5	3
E. W. Mote, 98 Grant's Road, Papanui ..	4·0	1
Majestic :—		
C. H. Wilson, Lorne, Invercargill	6·5	1
A. J. Clark, Box 34, Rangiora	6·5	10
Early Regent :—		
M. S. Kelly, 502 Lincoln Road, Halswell ..	3·5	2
J. Curragh, Templeton	3·0	1½
Endurance :—		
H. Weaver, Bankside	12·0	3
Iron Duke (Aberbrothok) :—		
H. Hancock, Awahuri, Palmerston North ..	10·5	12
Field Marshal :—		
L. T. Wright, Annat	9·0	5
Great Scot :—		
A. Spillane, John Street, Temuka	5·5	3½
Golden Wonder :—		
J. Warren, Russley Road, Fendalton	6·0	1
Maori Chief :—		
E. R. Wilson, St Andrews	9·0	2
Robin Adair :—		
D. Marshall, R.M.D., Killinchy	6·5	3
North Downs :—		
L. Galletly, Maronan, via Ashburton	4·0	2
Brownell's Beauty :—		
F. McNae, R.M.D., Courtenay	10·0	3
Northern Star :—		
W. Buttery, Pukekohe	*	½
L. J. Bayley, Pukekohe	*	½
E. J. Campbell, Pukekohe	*	2
G. Gathercole, Pukekohe	*	1½
R. E. Morland, Pukekohe	*	½
J. W. McMiken, Pukekohe	*	7
H. Wilcox, Buckland	*	4

* No cropping-power figures available.

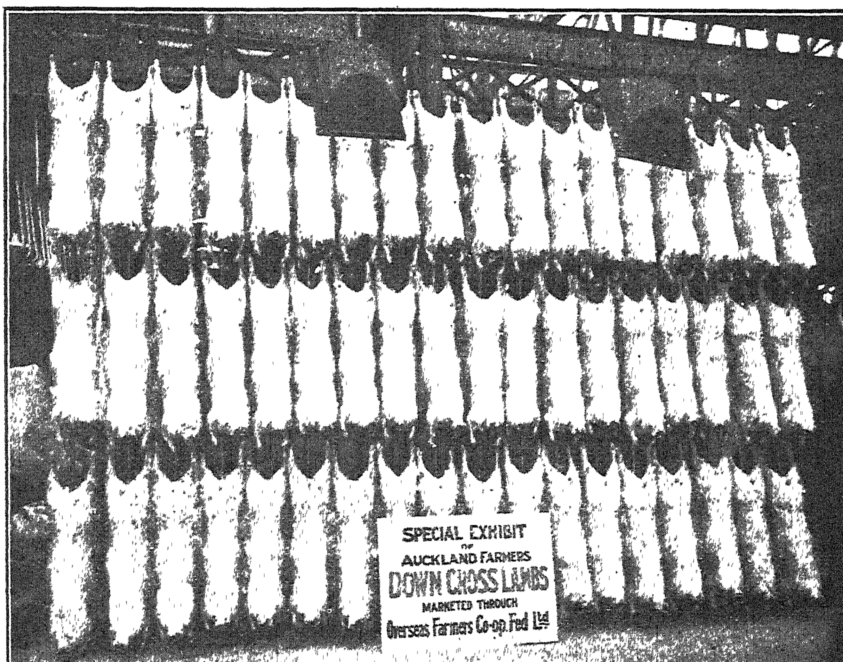
—*Fields Division*.

Sheep-shearing.—In his interim report on wool-production in New Zealand Dr. J. E. Nicholl refers to this subject as follows: "There is much controversy respecting the merits of blade as opposed to machine shearing, and in many flocks a return has been made to the former, it being claimed that when blades are used the short fleece left on the animal is a better protection against untoward weather conditions, and that it is possible with the British breeds to take better advantage of the 'rise' in the wool. In this connection it may be mentioned that the time of shearing and the nutriment available to the sheep after shearing may possess a definite bearing upon the presence of 'thickened tip' in the next fleece."

DOWN-CROSS EXPORT LAMBS FROM RUAKURA.

TOGETHER with the breeding of pedigree dairy cattle, sheep, and pigs, and the production of butterfat, the raising and fattening of lambs for export is an important activity at the Ruakura Farm of Instruction, Hamilton. Southdown rams are used on Romney crossbred ewes of the farm flock, with excellent results.

During the past season 1,672 fat lambs were shipped to London through the Auckland Farmers' Freezing Co. From the first consignment of 510 carcasses a special display was made at Smithfield by the Overseas Farmers'



DISPLAY AT SMITHFIELD MARKET OF SOUTHDOWN CROSS LAMBS BRED AND FATTENED AT RUAKURA FARM OF INSTRUCTION.

Co-operative Federation, who marketed the lambs, as shown in the accompanying photograph. The following extract from a letter received from the Federation is interesting and speaks for itself:—

"These lambs shown on Smithfield Market to-day were an excellent representation of the quality one is learning to expect and respect from the Auckland Farmers' work. They were shapely and well covered, giving a depth of meat which one always finds in the Down-cross; as a parcel representative of the quality now slaughtered regularly in the Auckland district one cannot praise it too highly. As has been the opinion of a few here for some years past, the Auckland brand is now coming into its own, due in great measure to the predominance of the Down. It is not so many years ago that these lambs were at a discount, due mainly to indifferent breeding and slackness in grading. Now this has all been changed, and the Auckland lamb is fast coming to the fore, with a round shapely carcass, thick and chubby, full of meat, and of good colour."

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

BLINDNESS IN SHEEP.

J. F. ROLLEY, Marohemo :—

Can you tell me what causes blindness among sheep at this time of the year (April)? I have several cases where the sheep are totally blind—running into fences, &c, as proof. Is there a cure for this?

The Live-stock Division :—

The origin of this blindness in sheep is accepted as being due to some dietetic cause, and therefore the feed is the primary cause, although it may only temporarily be the cause It is advisable at all times to change the flock on to different pastures at intervals, as found convenient Animals affected should be kept in a shady paddock by themselves, so that they may be better looked after and given treatment. The remainder of the flock should be shifted about, thus giving them more exercise and a better chance of not contracting the disease. The affected animals should be given a dose of Epsom salts—say, 4 ozs dissolved in a pint bottle of warm water and a little treacle The eyes may with advantage to the comfort and recovery of the animal be treated by washing with a little boracic acid dissolved in hot water (a tablespoonful to the quart bottle) and afterwards putting into the eye a few drops of hydrogen peroxide solution (one part of the hydrogen peroxide to four or six of water) So far as this disease is concerned there is no specific cure. One has to use ordinary common-sense as regards removing affected animals and applying treatment in the early stages

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CONTROL OF BURDOCK ON HILL COUNTRY.

M. G. WILLIAMS, Wairoa :—

Please advise me as to the best method of getting rid of burdock from hill country—how to kill the roots, and the best time of year for doing it. The burdock is at present confined to small patches, but is showing signs of rapid spread.

The Fields Division :—

The occurrence of burdock on your property should occasion no alarm, provided you allow stock access to it. No doubt it is growing in isolated inaccessible spots not traversed by stock. If stock have access, it will readily be grazed and probably eaten right out. If this procedure is not possible, the only other method of control would be to grub it out. The Fields Division has had distinct success in spraying certain soft weeds, such as ragwort, &c, with sodium chlorate as a means of eradication, but so far has not tried this remedy on burdock. Should you possess a knapsack spray-pump and be desirous of making a test with this spray on burdock a small quantity of sodium chlorate could be supplied for trial

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FARM PRACTICE FOR PHOSPHATE DEFICIENCY.

"DAIRY-FARMER," Kaihiku :—

As my cows are inclined to chew bones and sticks I propose adding some salt to their pasture when I top-dress the field. Can you please advise me how much per acre of salt would be a reasonable quantity. (I have in hand some waste salt from the hide-stores)

The Live-stock Division :—

The inclination to chew bones and sticks is usually indicative of a phosphate-deficiency. In many districts where this habit was once quite common it has

been completely overcome by cultivation and the extensive use of phosphatic manures principally superphosphate Your top-dressing should therefore consist largely of phosphatic manures, 3 cwt to 4 cwt per acre in the spring, and lime in the autumn There is no reason why you should not use the salt you have available, applying anything from 1 cwt to 3 cwt per acre The provision of salt in the form of rock salt for the cattle to lick would be an advantage. In order to increase the amount of phosphate available, you might use the following lick, which could be put out in boxes in the paddocks . Steamed bonemeal, 100 lb. ; coarse agricultural salt, 50 lb , sulphate of iron, 2 lb

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TREATMENT OF WARTS ON COWS' TEATS.

"DAIRYMAN," Hastings :—

Could you give me a prescription for curing warts on cows' teats I have several cows affected, and always wash the teats before milking and put crude castor-oil on them This certainly keeps the warts from becoming dry and hard but does not cure them.

The Live-stock Division :—

As castor-oil does not appear to give you satisfactory results for the elimination of warts on the teats more effective measures should be tried During the non-lactation period it will be advisable to snip off the warts at their base with a pair of sharp scissors Afterwards lightly dress the resulting cut surface with a stick of caustic silver nitrate This procedure has been found quite effective

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OATS AND VETCHES FOR ENSILAGE.

"SUBSCRIBER," Kohuratahi :—

Please advise me whether it would be good practice to sow oats and peas (or vetches) in September, following a swede crop I would want the crop for ensilage to be harvested early in January If this procedure is advisable, what kind of oat would be best ?

The Fields Division :—

It would be quite good practice to follow the swede crop with a mixture of oats and peas (or vetches) sown in September, and this should give you a good bulk of well-balanced material in December or January for ensilage. Sow Algerian oats, 2 bushels, with 1 bushel of vetches, per acre. Vetches are preferable to oats, as peas usually come to maturity ahead of the oats, while for your purpose vetches would provide their greatest bulk and be about the same stage of growth as the oats when cut

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RIDDING LAWN OF YARROW.

W T. GARTHWAITE, Dunedin :—

Will you kindly advise me the best method to adopt to rid my lawn of yarrow.

The Horticulture Division :—

The best method to adopt depends on the circumstances. If the yarrow is distributed generally over the surface it will be necessary to dig the lawn up and clean the land before resowing with grass-seeds that are free from serious weeds. Or by hard raking and close cutting at this season it can be checked to permit the grasses to become better established. If the yarrow occurs only in isolated patches it may be carefully removed now and replaced with suitable turf.

Introduction of Ship's Garbage prohibited.—An amending regulation under the Stock Act for prevention of the introduction into New Zealand of stock-diseases, gazetted on 17th April, prohibits the introduction into the Dominion from vessels arriving from other countries of any organic refuse, garbage, galley-scraps, or other waste.

WEATHER RECORDS: APRIL, 1930.

Dominion Meteorological Office.

GENERAL NOTES.

APRIL was remarkable for the high proportion of dry and sunny weather and the relative absence of storms There was a prevalence of anticyclonic conditions with southerly winds. Consequently, although the amount of sunshine was above normal, temperature was slightly below and frosts were rather numerous, especially in the South Island.

The rain which fell did not occur in general heavy falls, but was rather erractically distributed, much of it came in the last three days of the month. Taranaki and the Manawatu districts fared well, but in parts of the remainder of the country, and especially Canterbury and Otago, March and April both having been on the whole cool and dry, there is likely to be some shortage of pasture feed during the winter. The total rainfall was above normal in North Auckland, about East Cape, over the lower-lying parts of Taranaki and Wellington, most of Marlborough, and about Nelson. In other parts it was almost everywhere below average, and in the South Island especially the deficits were large

Throughout the month storms were almost continually developing in subtropical waters to the north of the Tasman Sea and thence eastward to beyond New Zealand. The majority of these failed to affect the Dominion directly to any great extent, though they assisted in the production of the prevailing high pressure and southerly and south-easterly winds. Though causing fine weather over most of the Dominion, the latter were responsible for unpleasant and showery weather in North Auckland and north of Napier.

There was remarkably little wind in most places during the month, and such gales as occurred were short-lived.

Snow fell on the highlands of the South Island on the 9th and 10th and the 29th and 30th, but the amounts were not large, and the mountains are unusually free from snow.

There were only three periods when rain was at all widespread. The first was from the 8th to the 11th. Between these dates all parts of the country received rain, and the total registrations were heavy at many places. The rain was due to a cyclone which appeared near Tasmania on the 5th. Pressure was high to the east of New Zealand, and the storm centre, moving slowly eastward, gradually lost intensity. It crossed the Dominion on the 8th, producing only light to moderate rains. On the 9th, however, a secondary developed west of the South Island and moved across northern Otago. The rain became more general and there were many heavy falls, especially in the South Island. Some violent thunderstorms were reported. Exceptionally heavy rain fell on the 9th in the Motueka and Moutere districts and as far inland as Tapawera. At Upper Moutere 8·19 in. were recorded, and the resulting floods were the heaviest ever experienced locally. In the district about Woodville, Pahiatua, and Waipukurau, also, there were severe thunderstorms and heavy downpours. Conditions remained rather disturbed until the 12th. On that day a cyclone centre passing north of New Zealand caused southerly gales in North Auckland.

On the 19th a cyclone which seemed likely to bring good rains to the Dominion appeared in the North Tasman Sea. Unfortunately, it took a northward course and passed between New Zealand and Norfolk Island on the 20th. Some rain fell in the northern and western parts of the North Island, Taranaki and the Wanganui and Manawatu districts experiencing some heavy falls.

On the 24th another cyclone of considerable intensity developed near Tasmania. Pressure was again high to the east of New Zealand, and, as in the beginning of the month, the storm made slow progress towards New Zealand and lost intensity. However, while it was crossing the

RAINFALL FOR APRIL, 1930, AT REPRESENTATIVE STATIONS

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
	North Island.				
		Inches		Inches.	Inches.
1	Kaitaia	4·02	11	0·93	3·55
2	Russell	5·38	18	1·36	3·59
3	Whangarei	7·45	21	2·11	4·45
4	Auckland	2·85	15	0·88	3·46
5	Hamilton	1·90	8	0·52	3·86
5A	Rotorua	5·91	8	2·37	4·35
6	Kawhia	2·91	10	1·10	4·64
7	New Plymouth	5·11	13	2·39	4·51
8	Riversdale, Inglewood ..	7·58	10	3·13	8·39
9	Whangamomona	5·57	9	1·42	6·62
10	Eltham	5·29	10	2·70	5·16
11	Tairua	3·76	16	1·54	6·33
12	Tauranga	3·32	9	1·60	5·08
13	Maraehako Station, Opotiki	5·38	11	2·38	4·57
14	Gisborne..	1·32	12	0·37	4·20
15	Taupo	1·98	8	0·58	3·77
16	Napier	1·60	12	0·40	2·92
17	Maraekakaho Stn., Hastings	..	..	..	3·14
18	Taihape	1·55	9	0·62	3·15
19	Masterton	2·62	7	0·82	3·05
20	Patea	4·50	9	2·40	3·59
21	Wanganui	3·33	7	1·47	3·37
22	Foxton	2·93	8	0·92	2·47
23	Wellington (Karori) ..	4·27	6	1·50	3 80
	South Island.				
24	Westport	5·32	10	1·18	8·25
25	Greymouth	4·49	9	1·25	8·37
26	Hokitika..	4·51	11	1·00	9·38
27	Ross	5·08	8	1·05	12·55
28	Arthur's Pass . ..	3·35	5	1·39	16·16
29	Okuru	4·94	11	1·12	13·67
30	Collingwood	5·79	7	2·45	8·07
31	Nelson	4·72	8	1·50	2·93
32	Spring Creek	2·49	8	0·95	1·72
33	Tophouse	7·76	9	2·02	4·22
34	Hanmer Springs	1·69	6	0 93	2·99
35	Highfield, Waiau	2·96	7	1·10	2·66
36	Gore Bay	2·64	7	1·11	1·77
37	Christchurch	0·53	7	0·22	1·97
38	Timaru	1·50	8	0·74	1·51
39	Lambrook Station, Fairlie ..	1·40	9	0·68	1·95
40	Benmore Station, Clearburn	0·87	5	0·36	2·55
41	Oamaru	0·94	8	0·40	1·78
42	Queenstown	0·60	10	0·31	3·00
43	Clyde	0·36	5	0·10	1·34
44	Dunedin	1·43	11	0·54	2·82
45	Wendon	0·94	8	0·35	3·16
46	Gore	0·87	11	0·19	3·15
47	Invercargill	1·23	14	0·35	4·36
48	Puysegur Point	4·88	19	1·13	7·98
49	Half-moon Bay	2·17	13	0·57	5·29

Dominion on the 28th northerly winds brought very warm and sultry weather, and conditions became favourable for rain when the southerly set in. On the 29th the depression developed a secondary centre west of the North Island. This crossed the Dominion and finally died out on the 30th. By that time general rains had fallen, with many heavy falls from Nelson and Marlborough northwards. These came for the most part on the night of the 28th and on the 29th, and were accompanied in places by thunderstorms, the lightning being particularly severe at Auckland.

—*Edward Kidson, Director of Meteorological Services, Wellington, 6/5/30.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 13th March to 8th May, 1930, include the following of agricultural interest:—

No 61631 Kapok substitute from flax: H S. F. Wright, Wellington. No 61632: Cotton-waste from flax; H S F Wright, Wellington. No 61831: Bleaching of fibre, A Steven, Shannon No 62501. Manure-distributor; K. Butler, Inglewood. No 62681. Milking-machine claw; J M. Judd, Wellington. No. 62688: Harrow and scarifier; R A. White, Hunua No 63619: Shearing-machine hand-piece tensioning, J Davidson, Sydney, N.S W. No. 63709 Manure-distributor: J. Taylor and Co., Ltd, Eltham. No. 64086: Stump-grubbing hook; C. Anderson, Shannon No. 62296: Incubator, J W. and B Roundhill, Fairlie. No. 62612 Cultivator; J E Holland, Hillsborough, Christchurch No 62459: Manure-distributor, H W Gower, Ohakune No 63245: Cream-separator; A E Denham, Wellington No 63539· Butter-box; M. A. Scott, Frankton Junction. No 62216. Apple-grading, J Oxley, Loburn No. 63079: Turnip and manure ridger; J. E. Mitchell, Wyndham No 64228· Egg-holder; J. Zimmer, Auckland No 64406· Hay-rake; The Farmers' Trading Co, Ltd, Auckland No 64461 Cheese-crate: M A. Scott, Frankton Junction. No 64558: Cultivator, H Mote, London, England No 64605. Harvesting-machine; L. F. Moroney, Lara, Victoria No 62793· Harrow; C A Barrell and J. D. Cann, Hamilton No 63053. Plant-support, E G Hollebone, London, England. No 63224: Chain harrow; C A Barrell and J D Cann, Hamilton No. 64589: Mixture for eradication of blackberry, R J Taylor, Motueka. No 64637: Agricultural implement; C. C Clark, Horsham, England

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid

FORTHCOMING WINTER SHOWS.

THE following dates have been notified by show secretaries:—

Waikato Winter Show Association: Hamilton, 27th May to 3rd June.
Otago A. and P Society. Dunedin, 31st May to 5th June.
Wairarapa Winter Show Association: Masterton, 2nd to 7th June
Taumarunui Winter Show Association: Taumarunui, 4th to 7th June.
Taranaki Metropolitan Agricultural Society: New Plymouth, 10th to 13th June.
Poverty Bay Winter Show Association. Gisborne, 11th to 14th June.
Manawatu A and P. Association· Palmerston North, 17th to 21st June.
South Taranaki Winter Show Company: Hawera, 25th June to 2nd July.
Te Kuiti and District Winter Show Association: Te Kuiti, 2nd to 5th July.
Wellington Winter Show Association· Wellington, 8th to 26th July.
Auckland Winter Exhibition: Auckland, 9th to 19th July
Canterbury A. and P. Association· Christchurch, 9th to 23rd August.

Correction.—Control of Ragwort: In the title of the illustration on page 293 of this issue the name "Hooper" should be "Hooker."

The New Zealand

Journal of Agriculture.

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PERENNIAL RYE-GRASS STRAIN INVESTIGATION.

DATA FROM TRIALS AT THE PLANT RESEARCH STATION.

E BRUCE LEVY, Agrostologist, and WM. DAVIES*, Plant Geneticist, Plant Research Station, Palmerston North

IN this *Journal* for July, 1929, it was pointed out by the writers that marked variation existed in commercial lines of perennial rye-grass. In the account of the early trials the fact of the annual Italian rye-grass element in the lines of different origin was clearly set out, and some idea was given that marked differences existed in the behaviour of the perennial rye-grasses of various origin, apart altogether from the Italian rye-grass present in the line (Table 1, page 4, July, 1929). The present article deals in greater detail with the trials conducted at the Plant Research Station, Palmerston North, and aims to set out the technique employed and the results gleaned to date.

In our preliminary report we stated that Hawke's Bay and Poverty Bay rye-grass as commercially handled in New Zealand was as a type quite different and apparently quite superior to rye-grass harvested in oth r parts of the Dominion. While the tabulated results as set out her are based largely on data secured from one- and two-year-old plot , yet much confirmatory field evidence has been secured from areas sowi by the Fields Division extending over a considerable period. Furtner than this, circumstantial evidence of farmers who have used Hawke's Bay rye-grass for many years and evidence collected by the writers on the Hawke's Bay and Poverty Bay flats would lead us to the definite conclusion that, provided the conditions are good enough to grow rye-grass, the Hawke's Bay strain will maintain itself as a dominant in the sward for any number of years. So marked, in fact, is the superiority of this strain over other strains that the Department of Agriculture this season initiated an extensive scheme of rye-grass seed certification, which really represents the first practical step towards a righting of the rye-grass strain position in New Zealand. †

* Member of Staff of Welsh Plant Breeding Station, Aberystwyth, seconded to Plant Research Station, Palmerston North.

† See article, "Certification of Grass and Clover Seeds," by J. W. Hadfield, in this *Journal* for November, 1929.

Details of Trials and Technique employed

The trials include (1) broadcast plots, (2) turfs or seed of rye-grass from various habitats planted or sown in rows, and (3) single spaced plants.

(1) Broadcast Plots

Where sufficient seed is available broadcast seedings are made, and the standard plot adopted is $\frac{1}{500}$ acre in area, the measurement being 30 links by $6\frac{2}{3}$ links. The amount of seed sown is 40 lb. per acre. These plots are sown in duplicate, and are subdivided transversely into three parts to allow a triple system of utilization to be carried out. One part is mown consistently once every week with a lawn-mower; the second part is mown with a motor hay-mower when the grass is in the 6 in. to 8 in. "cattle" stage; and the third portion is similarly cut at the hay stage when the grass is in flower. No reseeding is permitted to take place. The plots are uniformly manured with superphosphate and sulphate of ammonia, and a high standard of soil-fertility is maintained throughout the period of the trials.

Detailed observations have been made from time to time on the behaviour of each line under this triple system of utilization, and a system of relative marking by eye estimation is employed. A scale of marking, 0–10, has been adopted in respect of differences between plot and plot. Establishment, relative growth, persistency, recovery after cutting, type as shown by morphological and colour differences, swarding characteristics, and disease resistance or susceptibility are measured in this way. Eye estimations in regard to persistency and swarding characteristics under weekly cutting are wherever possible supported by accurate statistical analyses of the sward *in situ*, using the point-quadrat method.

No stock-grazing has been done on the trial plots under consideration, but the same lines or representatives of the same types have been sown out in the field on all the leading soil-types in New Zealand, and the behaviour of each line or type in the field is closely correlated with that in the mown series at the Plant Research Station. All told, 3,590 plots of rye-grass, representing some 300 different lines, have been sown out and are under grazing trial in the field. These field trials are yielding important data which it is hoped will form the subject of a subsequent paper by the writers.

In the trials at Palmerston North no effort has been made to secure cut weights of herbage produced by each line or type. We are of the opinion, so far as species and strain trials are concerned, that mere weights as such, without further and complete botanical analyses, are not worth while. The need for botanical analyses of cut herbage, if weights are used as a measure of increase or decrease, can be readily seen from a glance at Table 7. The enormous increase in white clover would largely counteract loss of rye-grass as far as the weight measure was concerned, and this could be shown only by dissecting out and separately weighing the components of the cut herbage of each plot, or by some comparable system of accurate estimation of the botanical content of that herbage. From our experiences with a limited working staff it is more practicable in preliminary trials where wide differences occur to concentrate on the testing out of a large number of lines; and

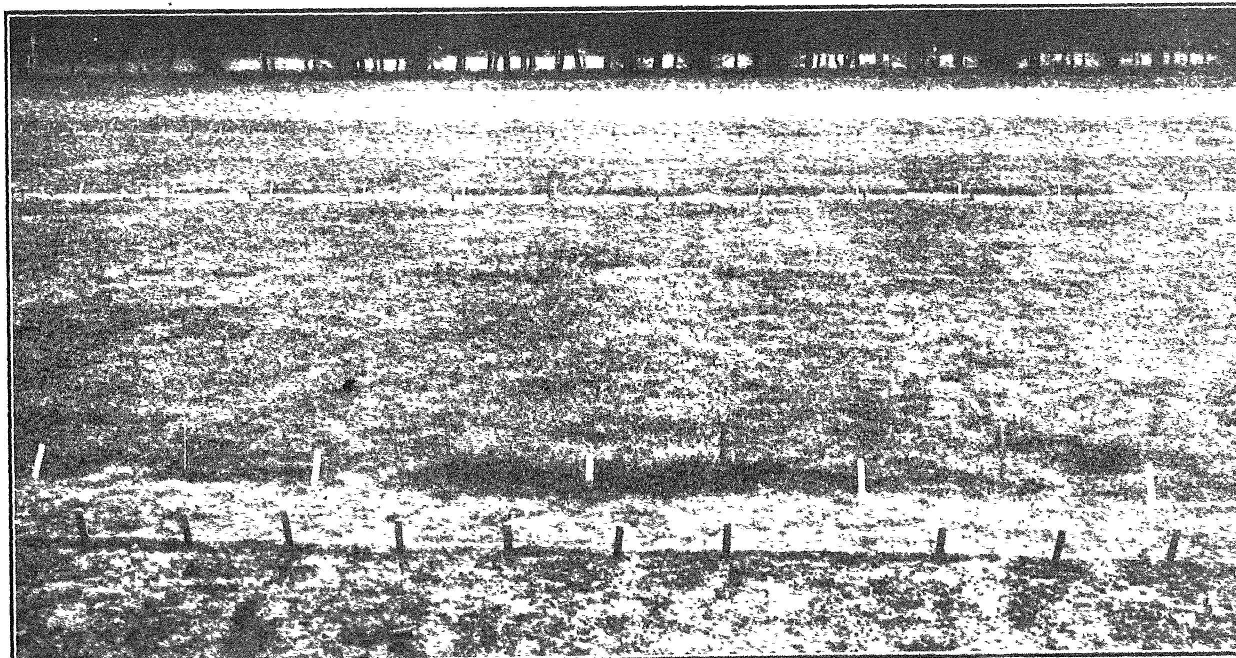

FIG. 1. VIEW OF PORTION OF TRIAL GROUNDS AT PALMERSTON NORTH

This photo shows differences at an early stage in the broadcast plots of commercial "perennial" rye-grass lines under test. These differences have been closely studied in the broadcast under differential mowing and in single plants drawn at random from the plots. [*Photo by E. Bruce Levy.*

to analyse these by eye estimation carried out at regular intervals, supported by accurate notes taken in the field, together with sward analyses *in situ* of representatives of the major types that assert themselves.

Up to date between 1,700 and 1,800 lines of perennial rye-grass seed have been received at the Plant Research Station for testing in the ground trials, and of these some 1,500 lines have been sown in broadcast plots in duplicate and subjected to the aforementioned triple-mowing scheme under constant observation and note-taking.

(2) TURFS OR SEED FROM VARIOUS HABITATS PLANTED OR SOWN IN ROWS.

Where turfs are collected in the field or where insufficient seed is available to sow the standard broadcast plot the row system of testing is adopted. The rows are either 15 links or 30 links long and are 2 ft. apart. When the seed is well up or the transplanted tillers well established the bed to half its width is sown broadcast with a more or less lawn-seed mixture not containing any seed of the species under trial in the rows, and this half portion is treated as a broadcast plot and cut weekly with a lawn-mower. Thus half the row is tested as under broadcast conditions and the other half is kept intercultivated. It is our opinion that the intercultivated-row system alone is not an adequate test for pasture plants, particularly those that definitely have their crown above ground. Rye-grass, cocksfoot, red clover, and timothy come within this category. Some 250 lines of rye-grass have been planted or sown in the above trials.

(3) SINGLE SPACED PLANTS.

In the broadcast plots eye differences as to type manifested themselves after some eight weeks from sowing. In order to study the individual plants that in the aggregate gave rise to that eye difference single plants were taken at random, 100 from each broadcast plot. These were put out 2 ft. apart each way and studied as single plants from the point of view of growth-form, recovery after cutting, persistency, colour-variation, disease resistance or susceptibility, &c. This single-plant trial is yielding also a certain proportion of promising types, which are now being used as a basis for selection and for the working up ultimately of elite strains. The single-plant study is also showing up to a marked degree the entire lack of uniformity of type even in what we consider the best of the Hawke's Bay lines, indicating that enormous possibilities for improvement await the skilled hand of the plant-breeder and strain-ecologist.

In regard to the general procedure in the economic breeding of pasture plants and in the building-up of improved strains from selected material, and having due regard to the fact that these studies are merely in their infancy, we hold the view that the first step is to test out large numbers of types drawn from every corner of the globe, both as broadcast plots and as single spaced plants that are in all cases submitted to a number of contrasting schemes of management; to study growth-form in relation to yielding-power and persistency; to study type, tillering-capacity, seasonal growth, disease-resistance, and the like, both of the aggregate strain and of the dissimilar individuals that

make up that aggregate. Following on this preliminary survey, the more likely growth-forms can by mere selection and culling be grouped together to produce improved aggregate types that are likely to be vastly superior to the existing commercial types. Concurrently with this analysis and selection should go the genetical analysis of the several more likely growth-forms with a view to producing economically superior and more useful lines that are, within reason at any rate, genetically pure and are likely to remain so indefinitely under a carefully controlled scheme of seed-production.

During August, 1929, some 5,500 single plants of rye-grass, representing fifty-three distinct lines of seed, were planted as spaced plants, and a special report on the behaviour of these will be made at a later date.

PROGRESS RESULTS OF BROADCAST PLOTS.

After two years' concentrated work at the Plant Research Station, and as a result of several years' widely distributed trials and observations throughout the country, there is in the minds of the writers no shadow of doubt that the Hawke's Bay rye-grass as a type is superior, for New Zealand conditions at least, to any other commercial strain from any other source. Prior to this work species, or mixtures of these, were accepted in New Zealand as the only thing one had to consider in the laying-down of pastures. This work emphasizes that strain counts more than species, and that source of origin is a factor to be reckoned with in the buying of grass and clover seeds.

The Department is fully alive to the situation created by this work, and in order to give some means of guarantee as to type and district of origin it inaugurated and carried out, under the direction of Mr. J. W. Hadfield, Agronomist, the scheme of rye-grass seed certification already referred to. We recognize in this scheme the germ of an organization that may surpass in economic importance the stud-book of the stock-breeder and the milk test for the dairy cow. The support that seed-merchants and farmers are giving to this movement must ultimately be reflected in pedigree-seed production not only for New Zealand's own requirement, but substantially the basis of a large seed-export trade.

CLASSIFICATION OF COMMERCIAL RYE-GRASS ACCORDING TO TYPE.

In our trials we have been able to recognize six types within the commercial rye-grass of New Zealand, and as this classification is referred to throughout the present article descriptive notes of each type are given hereunder.

Type 1.—Hawke's Bay, Poverty Bay, and a few of the best Sandon lines have in general been placed in this group. Characteristically deep green in colour, making dense leafy growth at all seasons, and showing rapid recovery after cutting.

Type 2.—The bulk of Sandon rye-grass has gone into this group. Rather lighter in colour than Type 1, especially marked in the early growth stages; and this colour difference has later proved to be directly associated with a relative lessened persistency.

Type 3.—This group comprises the best of the South Island lines, which, while showing a fairly good colour, were as a whole more greyish-green in the early growth-periods, of divaricating habit in the broadcast plots, and having the individual plants open at the crown with more or less prostrate shoots. This type has persisted as well as Type 2 up to date, but not nearly so well as the best "true perennial" lines of Type 1.

Type 4.—The light-greyish-green colour, divaricating habit, and loose open crown associated with "false perennial" is typical of this group, which includes most of the Southland, Otago, and Canterbury lines, and may be regarded as the average "false perennial" coming from South Island districts. There is a very decided falling-off in persistency as compared with Type 3.

Type 5.—This type shows characteristic colour-differences very soon after soil establishment. Germination is as rapid as in Italian rye-grass, but looked on as a plot it typically assumes a steely grey-green colour quite distinct from the yellow green of Italian rye-grass or of the deeper green of true perennial rye-grass. The plants are spreading in habit of growth, and while making rapid seedling growth are unable to recover after being cut back. In many respects this type shows close affinities with Italian rye-grass, and in some ways is suggestive of a derivative of crossing between the normal "false perennial" of Type 4 and ordinary Italian. Single-plant studies have emphasized the approach to Italian rye-grass characteristics in this form, but it is important to note that in no case has the type shown the vigour associated with Italian rye-grass in the first year.

Type 6.—Normal Italian rye-grass sold as "perennial" or merely as "rye-grass." Single-plant studies have shown that there was a trace of perennial rye-grass in some of the lines placed in this group. The plots were all rapid in growth from seed, typically erect, and light yellowish-green in colour. Recovering well from the earlier cuts, Italian rye-grass failed to last the season, going out first and most completely on the weekly-mown section.

Distribution of the Types in New Zealand.

In Table 1 is set out the distribution in New Zealand of the commercial perennial rye-grass types according to source of origin as supplied with the seed. The figures indicate that most of the samples definitely stated to be of Hawke's Bay and Poverty Bay origin approach the "true perennial" type, whereas lines from Southland and Canterbury, including South Canterbury, are definitely of the "false perennial" type. Sandon rye-grass on the whole inclines towards the "true perennial"—in fact, a few of the best Sandon lines under test were indistinguishable from the average Hawke's Bay lines. Sandon rye-grass, however, taken as a whole, contains an excessive proportion of Italian rye-grass, some of the lines being dominant Italian with very little perennial. South Canterbury rye-grass is perhaps more predominantly Italian rye-grass than that from other sources of origin in New Zealand. Occasional samples were received, however, from Southland, Canterbury, Otago, Marlborough, and the Wairarapa, which proved to be dominant Italian.

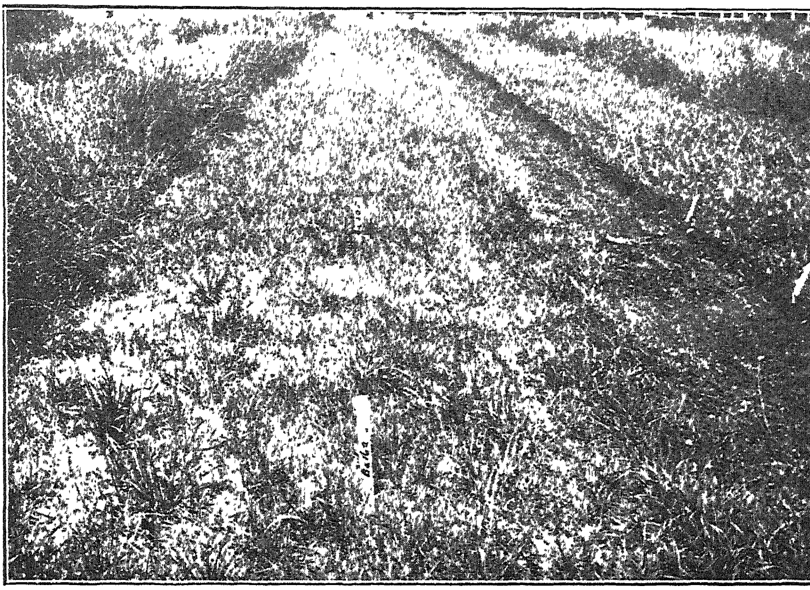

FIG. 2. RECOVERY OF FALSE PERENNIAL COMPARED WITH TRUE PERENNIAL.

In the foreground on left of path are two plots of false perennial (Southland Type 5), and behind the second label are six plots of true perennial (Hawke's Bay Type 1). The photo shows recovery after first hay-cut. The tall growth is the "cattle series" allowed to run up to flower.

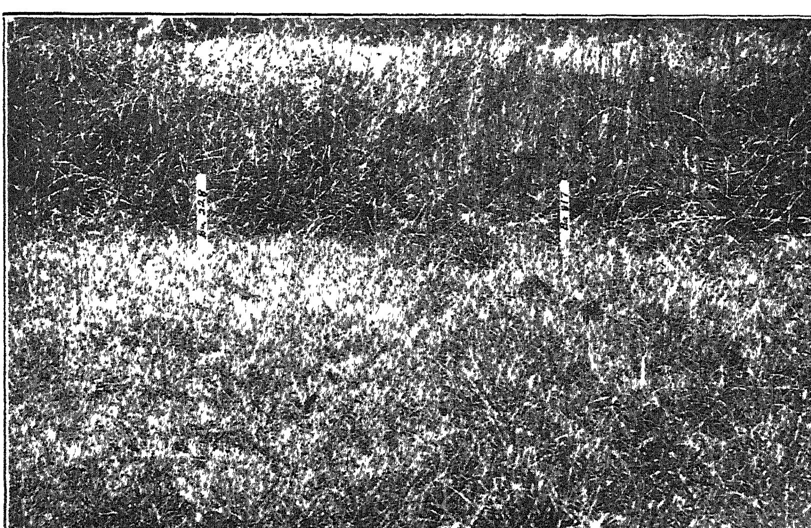

FIG. 3. SHOWING RECOVERY, IN FOREGROUND, AFTER HAY-CUT.

True perennial (Hawke's Bay Type 1) on right; false perennial (Canterbury Type 5) on left. Cattle series behind labels.

[*Photos by E. Bruce Levy.*

Table 1.—Strain Analysis of 841 Lines of Commercial "Perennial" Rye-grass of stated District of Origin.

District of Origin.	True Perennial, Types 1 and 2*—Number of Lines.	Best Type of False Perennial, Type 3—Number of Lines.	False Perennial, Types 4 and 5—Number of Lines.	Dominant Italian, Type 6—Number of Lines.	Total Number of Lines under Trial.	Percentage of True Perennial.
Hawke's Bay	175	1	8	5	189	93
Poverty Bay	32	..	2	1	35	92
Sandon	46†	3	8	7	64	72
Mid and North Canterbury	7	16	56	17	96	7
South Canterbury ..	3	9	38	34	84	4
Southland ..	3	27	269	9	308	1
Maniototo ..	2	4	16	2	24	8
Wairarapa .. .	5	1	3	3	12	42
Marlborough	2	7	1	1	11	18
Imported	1	9	7	1	18	6

* But may contain a trace of some Italian rye-grass. † Many lines contain a fair percentage of Italian.

RYE-GRASS TYPES HANDLED AT MAIN DISTRIBUTING CENTRES.

In Table 2 is set out the position as regards the type of rye-grass handled at the main distributing centres in New Zealand. Auckland handles rye-grass from all over New Zealand, but draws a not inconsiderable proportion from the Hawke's Bay and Gisborne districts. It would appear as if rather less than half the Auckland supplies are of the "true perennial" type.

The East Coast towns, Hastings, Napier, and Gisborne, deal in the main with locally-grown seed, as shown by the preponderance of the "true perennial" types that are handled. A small proportion of seed from the South Island, however, is brought in by these towns, especially in years when the local harvest is below normal. The inadvisability of this procedure is self-evident, and is emphasized by the poor results that have been obtained from sowings of Southern

Table 2.—Strain Analysis of 830 Lines of New Zealand Commercial "Perennial" Rye-grass as sold in the several Main Distributing Centres of the Dominion

Distributing Centre.	True Perennial, Types 1 and 2—Number of Lines.	Best Type of False Perennial, Type 3—Number of Lines.	False Perennial, Types 4 and 5—Number of Lines.	Dominant Italian, Type 6—Number of Lines	Total Number of Lines under Trial.	Percentage of True Perennial.
Auckland	25	3	23	3	54	46
Hawke's Bay and Poverty Bay	120	..	1	4	125	96
Palmerston North and Feilding	89	14	25	9	137	65
Christchurch and Ashburton	7	18	48	14	87	8
Timaru and South Canterbury	3	8	37	34	82	4
Dunedin	2	1	42	2	47	4
Gore and Invercargill ..	2	29	259	8	298	1

seed made from time to time in the East Coast districts. Palmerston North and Feilding draw a good deal of their supplies from the adjacent Sandon district, a small proportion is bought in Hawke's Bay, and a good deal from the South Island. The number of samples under test from Wellington was small, and the figures for this centre therefore had little significance. It is apparent, however, from our tests that Wellington deals in large part with rye-grass seed from the South Island.

Christchurch and Ashburton draw their supplies of rye-grass seed from the surrounding districts. The towns of South Canterbury—Timaru, Geraldine, and Waimate—are also supplied by local growers. Dunedin, Gore, and Invercargill appear to deal wholly with Otago and Southland rye-grass. The whole supply of the South Island towns being drawn from local sources is preponderantly of the "false perennial" type; the data emphasize really that these towns are export centres sending considerable quantities of their rye-grass to the North Island and overseas. This export means failure of the rye-grass in any permanent pastures sown down in the North Island, and militates against New Zealand gaining pride of place in the seed trade overseas.

The only consolation—if that it be—we have in the meantime is that no overseas country is producing a true perennial rye-grass type suitable for pasture purposes. The imported lines we have had under test are, as a whole, no better than the false perennial from the South Island.

Imported and New Zealand Types compared.

All the English, Irish, and Scottish lines have failed badly during the second year of trial; pedigree lines of leading Scotch firms, special indigenous perennial lines, Pacey's Evergreen, &c., as sold by leading English firms, have likewise gone out. Lines from Germany, Sweden, and Poland range from bad to good false perennial type, while an American line sold under the name of "Oregon awned perennial rye-grass" proved to be nothing more than ordinary Italian.

In this connection the following analysis of data comparing New Zealand and overseas types is illuminating :—

Table 3.—Comparison of the Six New Zealand Rye-grass Types with imported "Commercial Perennial."

Origin.	Relative Recovery after Cutting—Plots Eleven Months old.	Relative Excellence of Turf produced after Twelve Months.	Relative Persistency at Twelve Months as shown by Point Analysis	Relative Degree of Rust-resistance.
New Zealand Type 1	100	100	100	100
New Zealand Type 2	87	91	86	36 (Types 2–5)
New Zealand Type 3	70	80	88	
New Zealand Type 4	34	55	40	
New Zealand Type 5	15	25	32	
New Zealand Type 6	..	22	18	100
Imported	49	42	55	35

From these figures it will be seen that the average imported commercial type falls, as it were, in performance and behaviour between

Types 3 and 4. Persistency trials after eighteen months (see Table 6) would indicate that it was nearer Type 4 than Type 3. The high susceptibility of the imported lines to rust-attack emphasizes also the poor-growth and strain characteristic of these lines. Certainly, then, it would appear that New Zealand has nothing to gain by importing rye-grass for the purpose of improving the position as it exists to-day. Undoubtedly the problem that lies ahead of us is to make the best possible use of the available true perennial type we have in the Hawke's Bay and Poverty Bay districts; to sink any parochial differences we may feel, and to set to work in real earnest to propagate and improve this strain, not only for the country's own requirement but also to make fame for New Zealand rye-grass overseas, even as the Dominion is now famed for its butter, cheese, lamb, and apples, remembering also the value of another string to our bow in times of trade depression. The Department of Agriculture will be behind any such effort with the certification scheme now in operation.

NEED FOR CERTIFICATION SCHEME IN NEW ZEALAND.

The need for a proper scheme of certification is emphasized by the following statement, which is based on our trials in respect of lines stated to be of Hawke's Bay, Poverty Bay, and Sandon origin respectively.

Table 4.—Strain Analysis of Rye-grass Lines reputed to be of a certain District of Origin.

District of Origin.	True Perennial free of Italian—Number of Lines.	True Perennial containing a Trace or some Italian—Number of Lines.	False Perennial—Number of Lines.	Dominant Italian—Number of Lines.
	(1)	(2)	(3)	(4)
Hawke's Bay	135	40	9	5
Poverty Bay	25	7	2	1
Sandon	17	29	11	7

In the present certification scheme only those lines in column 1 would pass field inspection for mother seed. Those in column 2 would pass as fit for permanent pasture seed, while those in columns 3 and 4 would be rejected.

The point we wish to make here, however, is that none of our trials of rye-grass of guaranteed origin from Hawke's Bay and Poverty Bay have shown 100 per cent. false-perennial characters, and it would appear as though some 5 per cent. of the lines sold as Hawke's Bay are of South Island origin and some 17 per cent. of the Sandon lines are definitely South Island type. This also does not take into consideration the possibility of adulteration of Hawke's Bay, Poverty Bay, or Sandon with seed of Southern origin; and, while we do not wish to stress this point, many of the lines reputed to be of the former origin under strict weekly mowings have not stood this severe test as well as one would have liked. Price quotations, also, from overseas, particularly from Australia, would indicate that much false perennial of South Island origin was being sold in that country under the popular name of "Poverty Bay rye-grass."

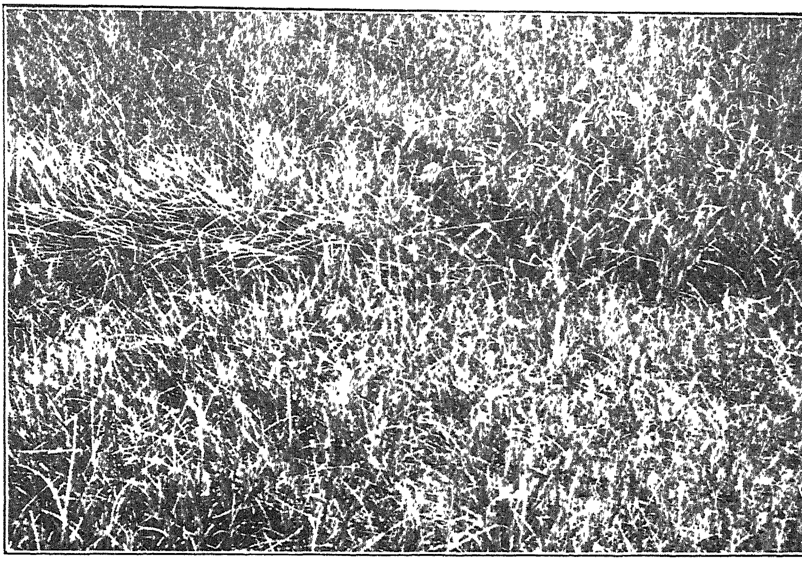

FIG. 4. RECOVERY "HAY SERIES" IN FOREGROUND AND "CATTLE SERIES" IN BACKGROUND.

True perennial (Hawke's Bay Type 1) on left, and dominant Italian (Marlborough Type 6) on right. Note that after the second hay-cut the true perennial is beating the Italian type in recovery. In the background, it will be seen, recovery after first hay-cut is dominantly towards leaf in Type 1 and towards stem in Type 6. Types 4 and 5 behave in this respect similarly to Type 6

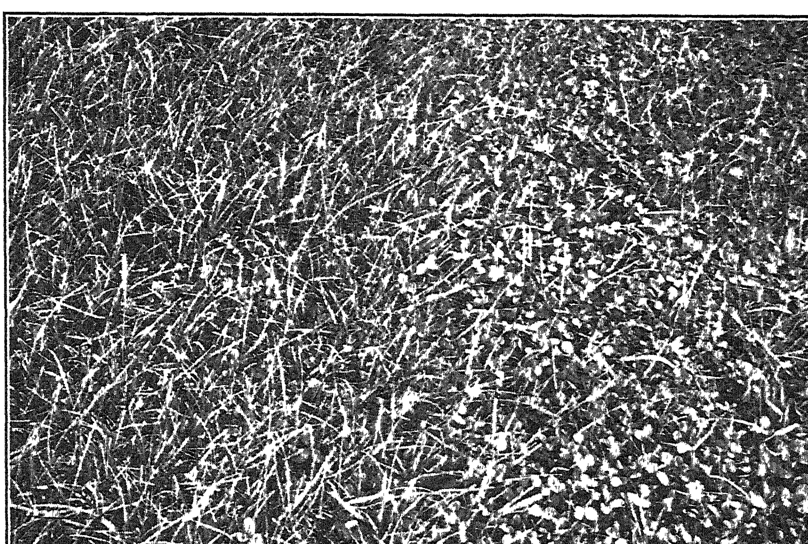

FIG. 5. SWARDING PERSISTENCY UNDER WEEKLY CUT WITH LAWN-MOWER.

True perennial (Hawke's Bay Type 1) on left, and dominant Italian (Type 6) on right. Same plots as shown in Fig. 4.

[*Photos by E. Bruce Levy.*

An article by Professor R. G. Stapledon, of the Welsh Plant Breeding Station, Aberystwyth—"Herbage Seed Production in New Zealand: IV. Perennial Rye-grass and Dogstail," published in the *Journal of the Ministry of Agriculture* (London) for September, 1927—is of interest in this connection. A summary is given of experience with New Zealand rye-grass at Aberystwyth. The comparative behaviour of authentic lines of Hawke's Bay rye-grass now being tested at that station will be of the utmost importance to seed growers and merchants in New Zealand.

TRUE PERENNIAL AND FALSE (OR PSEUDO) PERENNIAL COMPARED.

The difference between the true perennial rye-grass and the false perennial becomes apparent very soon after soil establishment. The true perennial (Hawke's Bay and Poverty Bay type) is rather less rapid in seedling growth, and after about eight to ten weeks takes on a distinct deep-green colour, the individual plants tending to be upright and the numerous tillers closely packed. Normally false perennials (Southland and Canterbury strains) establish more rapidly, and soon take on a yellowish and then a greyish-green colour. The crown is fewer-tillered and open, the whole plant being divaricating rather than erect, and the tillers loosely packed at the crown.

The false perennials and the true perennials made approximately equal growth during the first winter following autumn sowing; both were outyielded as winter producers by Italian rye-grass. When the system of differential cutting was initiated in the early spring, however, the false perennials did not show the ability to recover from frequent cutting, whereas the true perennials consistently showed rapid recovery even under the most severe weekly clipping treatment. Italian rye-grass recovered well from the earlier spring cuttings, but failed to persist after mid-season. The false-perennial types, therefore, while having none of the advantages of rapid winter and early spring production characteristic of Italian rye-grass, have also none of the persistency attributes of true perennial rye-grass.

The colour differences noted in the broadcast plots of Hawke's Bay as compared with South Island seed have definitely proved on the past year's experience to be associated with differences in persistency, seasonal production, and time of flowering. The deep-green, erect-leaved, tufted, and multitillered Hawke's Bay type has maintained itself even under frequent cutting, while the lighter greyish-green colour and divaricating habit of the Southern rye-grasses has been associated with lack of tillering and the inability to persist either in the hay section, under infrequent cutting in the "cattle" section, or under the system of weekly cuts. At all seasons during the past year the trial grounds presented a checkerboard appearance, where the more persistent actively-growing true perennials were alternated with the non-persistent almost truly annual rye-grass of the South Island.

This is quite apart from a consideration of the Italian rye-grass element, which is all too often found as an admixture in our commercial perennial rye-grass. Many lines from Hawke's Bay and Poverty Bay contain a small proportion of straight-out Italian rye-grass usually derived from maiden seed paddocks, but from a purely practical standpoint the small amount of Italian in the sample is of little consequence

for permanent pasture sowing so long as the sample is predominantly of the proper pasture type. In illustration of this principle we may mention one line of Hawke's Bay rye-grass under test which proved to be more than half Italian, but the remainder of the sample was true Hawke's Bay type. That plot now at eighteen months old is far and away better than adjacent plots sown with false perennial rye-grass which originally contained no trace of Italian. For pasture purposes, therefore, it is better to sow a good perennial rye-grass type even if the sample is found to contain a trace of Italian, than to sow the false-perennial annual forms no part of which will last into the second year of grazing.

In the leaf-shoots, seed-heads, and general seed crop the types of rye-grass show some characteristic differences. In the seedling stages the true perennial is invariably folded in the leaf-bud and the tiller is flat-stemmed. At a similar growth-stage the false perennial usually tends to roll or at least to be less perfectly folded in the bud, and the tiller just below junction of blade and sheath is more or less circular in cross-section. In the period just prior to panicle-production both the true and the false perennial incline towards a rolling of the leaf in the advanced tillers. The true-perennial seed-stalk stands stiffly erect with but slight tendency to droop in the seed-head itself. The false-perennial seed-stalk is not so erect, but divergent, with a decided droop or arch of the seed-head. This characteristic is perhaps not so marked in heavy seed-crops, but is extremely marked in crops which have been grazed until fairly late in the season—that is, in the lighter seed-crops where the heads are not drawn up but are permitted to assume their natural divergent and drooping habit. The true Italian rye-grass is always rolled in the leaf-bud, and the tiller stem is always circular in cross-section. The seed stem is erect and taller than those of the foregoing perennial types, and the admixture of the latter in either is readily discernible by this tallness, together with a marked drooping of the head and well-marked awn of the seed.

The true perennial is never awned; the false perennials are never strongly awned, but in a percentage of cases short awns or awn-points appear, especially near the apex of the panicle and in the apical and subapical florets of some of the lower spikelets. Many lines of false perennial show scarcely any awn, but the seed itself is usually bigger than the true perennial and the individual spikelets of the seed-head are broader and not so compact. There is no doubt in our minds that the absence of awn on these false perennials has been largely responsible for acceptance of this type by seed-buyers, who relied in the past so implicitly on the belief that unless a line was awned it must necessarily be perennial rye-grass. In our field inspection work during the past year in connection with rye-grass certification we definitely rejected any paddock that contained even a trace of heads carrying these short awns. The general divergent nature of the seed-stems and arched droop of the head in every case confirmed the short-awn diagnostic feature and identified the line as a false perennial rye-grass. We should like, however, to record our firm belief—even against knowledge in specific instances of hard dressing to remove awns—that most seed-merchants have bought and

sold these awnless false-perennial lines in the best of faith and belief that they were handling and offering true perennial rye-grass seed.

The general behaviour, growth-form, and structure of the false perennial would indicate intercrossing of perennial and Italian rye-grass, and from our general experiences we are of the opinion that the short-lived rye-grass characteristic of Southern seed has been derived firstly by unconscious selection of short-lived strains of perennial rye-grass consequent upon seed-production for long-continued periods under arable and short lea conditions, and secondly by the admixture in seedlings of this short-lived perennial rye-grass with Italian, with resultant intercrossing.*

It seems, therefore, that the false perennials are derivatives first by strain selection towards short-lived perennials, followed by an intercrossing of this type with Italian rye-grass.

Data in Relation to Recovery after Cutting.

The ability to recover after cutting is an important feature of a good strain of rye-grass. It is essential for pasture-production that a strain should show the ability to make year in and year out an abundance of new leafy growth immediately after grazing or mowing.

In this respect the true perennial alone fulfils the requirement. During the first nine months of the trials, Italian rye-grass beat the true perennial in recovery, but after the second hay-cut recovery of the true perennial was twice as rapid and complete compared with the Italian. At the peak of the Italian rye-grass growth this type produced in thirty-five days after the first cut as hay, 150 points, with Type 1 = 100; and at five days after the second hay-cut produced only 51 points, with Type 1 = 100.

The false perennials, particularly those of Types 4 and 5, failed badly to recover after each cut, and what recovery was made after the hay-cut was definitely of a stalky nature rather than leaf. The following observations made eleven months from sowing down and seven days after the second hay-cut on 17th February, 1930, give the relative recovery figure of the various types exclusive of Italian rye-grass (Type 6) that was contained as an admixture in certain of those lines. Type 1 gave best recovery = 100.

Type 1.	Type 2.	Type 3.	Type 4.	Type 5.
100	87	70	34	15

At no time during the year did the false perennials approach the true perennial in recovery, and this trait taken in consideration with the low persistency of these types, marks the false perennial as the least desirable of all rye-grass types to grow. It scarcely outlives the Italian in persistency; it fails badly to recover after cutting, and its total yield is far below either that of the true perennial or the Italian.†

* In his paper "The Artificial Hybridisation of Grasses," Welsh Plant Breeding Station, Aberystwyth, Series H. No. 2, Mr. T. J. Jenkin, M.Sc., records 74·3 per cent. success in hand-crossing perennial and Italian rye-grass. These seeds germinated quite readily and produced vigorous plants. It had been further ascertained by Mr. Jenkin that the hybrid plants were equally self-fertile to average progeny plants of Italian or perennial crossed *inter se*.

† More detailed evidence on recovery of types will be given when dealing with single-plant studies in a subsequent issue of the *Journal*.

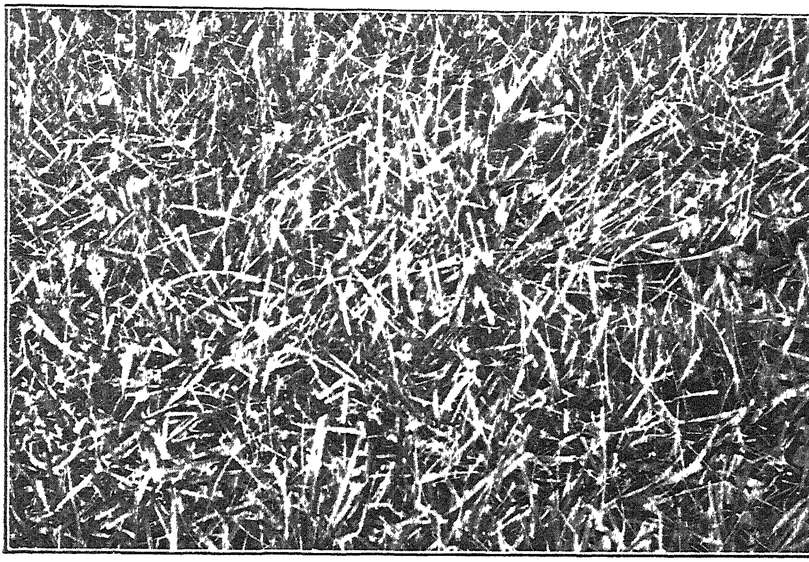

FIG. 6. SWARD PERSISTENCY, UNDER WEEKLY CUT, OF TRUE PERENNIAL (HAWKE'S BAY TYPE I) AFTER TWELVE MONTHS.
This plot records 72 per cent persistency.

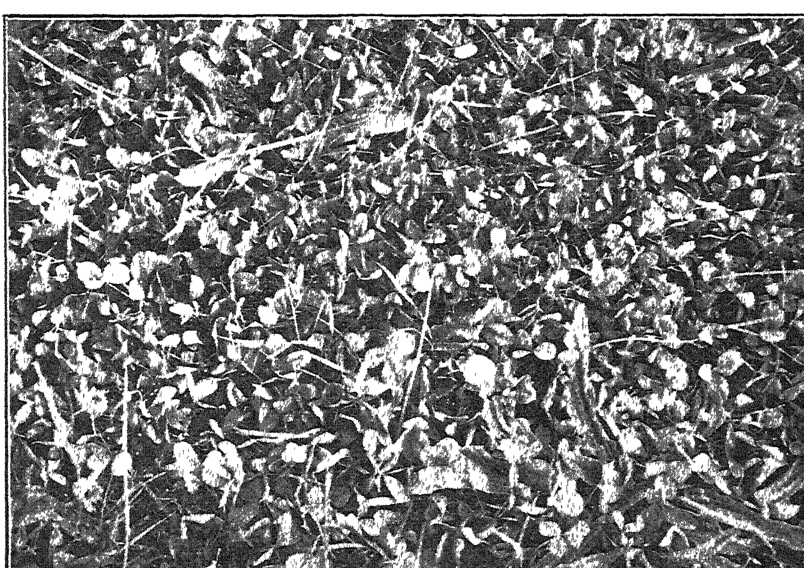

FIG. 7. SWARD PERSISTENCY, UNDER WEEKLY CUT, OF FALSE PERENNIAL (TYPE 5) AFTER TWELVE MONTHS.
This type averages 14 per cent. persistency. The plot shown is slightly below the average.

[*Photos by E. Bruce Levy.*

The high recovery figure for Italian rye-grass emphasizes the value of this species above all others for temporary-pasture work, but we would here stress the advisability of buying strongly-awned lines of seed, for it would seem that much of Type 5 finds its way on to the market as Italian rye-grass and this type cannot be compared with Italian in production and ability to recover after grazing or cutting.

Swarding Characteristics of the Six Main Types.

The ability of a rye-grass to persist and sward out and completely cover the ground is one of the most important attributes of any type. A weak rye-grass that tillers but little, or one that relies on persistency by reseeding, will never make a good permanent sward, and certainly will never keep weeds out of a pasture. White clover, particularly under phosphatic manuring, often becomes much too dominant in a pasture, and this is certainly the case where a weak non-tillering, poor-swarding type of rye-grass is used.

The point-quadrat analyses in Table 6 show in average figures according to source of origin the state of the pasture sward within the same plots nine months and eighteen months respectively after the plots were laid down. In Table 7 are given similar results of some representative lines from different sources of origin sown in a further series of plots in the autumn of 1929. These analyses are arranged according to type and both sets of analyses were made on the "weekly mown" portion of the plots.

Table 6.—Point-quadrat Analyses of Representatives of 104 Rye-grass Lines sown November, 1928.

Origin.	Average Hits per 100 Points examined. After Nine Months.	Average Hits per 100 Points examined. After Eighteen Months.	Relative Persistency Figure with Average Hawke's Bay Seed = 100.
Hawke's Bay	41·6	25·6	100
Sandon	31·3	19·6	77
Wairarapa	31·2	10·4	41
Marlborough	29·0	7·0	27
Mid-Canterbury	28·2	7·0	27
Southland	29·7	7·2	28
Imported "Commercial"	30·6	4·6	18
South Canterbury	29·0	3·0	12

Table 7.—Point-quadrat Analyses showing Average Swarding-capacity and Persistency of the Representative Rye-grass Types under Weekly Mowing Trials (195 Lines sown March, 1929; 57 Lines critically examined).

Type.	First Analysis made at Six Months—Hits per 100 Points. Total Rye-grass.	First Analysis made at Six Months—Hits per 100 Points. White Clover.	Second Analysis made at Twelve Months—Hits per 100 Points. Total Rye-grass.	Second Analysis made at Twelve Months—Hits per 100 Points. White Clover.	Percentage of Persistency of Rye-grass, 6–12 Months.
1 and 2*	72	2	34	40	47
3	75	2	26	36	35
4	78	1	17	57	22
5	83	1	12	55	14
6	71	1	6	57	8

* One line only of Type 2.

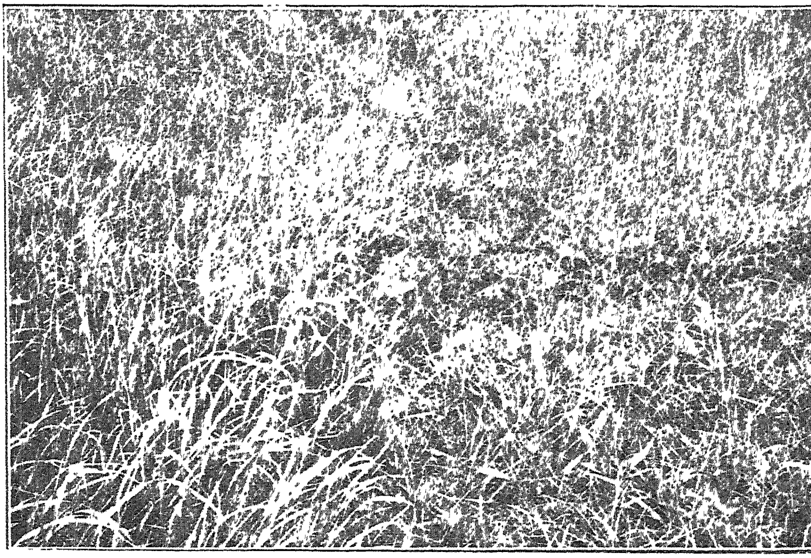

FIG. 8. RECOVERY OF FALSE PERENNIAL COMPARED WITH TRUE ITALIAN

True Italian line on left; false perennial (Southland Type 5) on right. The false perennial does not recover so well as Italian after cutting, and in view of its low persistency is inferior to Italian for temporary pasture.

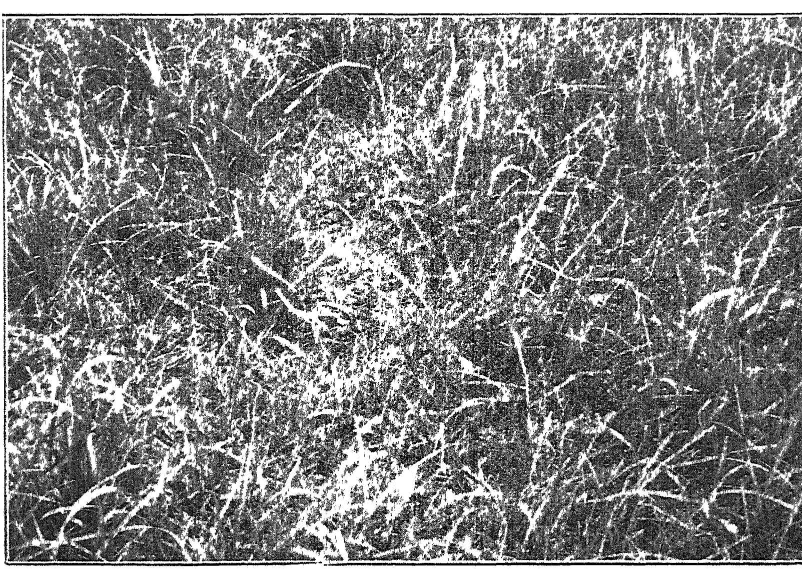

FIG. 9. RECOVERY, AFTER HAY, OF THREE TYPES.

True perennial (Poverty Bay Type 1) on right, Italian (odd outstanding plants) on left, and false perennial (rye-grass other than Italian) on left. The line on the left was a mixed false perennial and Italian rye-grass from the Wairarapa.

[*Photos by E. Bruce Levy.*

Viewing the above persistency figures some consideration should be shown in regard to the severity of the trial to which these turfs have been subjected. Weekly mowing with a lawn-mower is a severe test, not only from the point of view of clipping back the rye-grass but also from the strong competition that arises by the incoming and spread of volunteer white clover and weeds. As a matter of general interest the white clover figures have been included in Table 7, and it is interesting to note that the plots in which the weaker types of rye-grass were sown have on the whole run dominantly to white clover. No white clover was sown in laying down these plots. This state of affairs has without doubt been the experience of many farmers sowing down ordinary commercial rye-grass, and particularly under systematic top-dressing with phosphate.

Even among the genuine Hawke's Bay rye-grass there are low-persistency lines, but in no case have we met with extremes as shown in groups 4, 5, and 6. A few lines show very high persistency considering the treatment, and we have already initiated work at the Plant Research Station to reproduce as rapidly as possible a supply of seed (Line Ba. 12) for further experimental work, which we hope may ultimately form the nucleus of an elite persistent strain well above the standard of the present Hawke's Bay average lines.

In addition to the point-quadrat analyses presented in Table 7, eye determinations were made of the same plots at twelve months. The following figures are of interest as correlating the two methods of analysis :—

Table 8.—Showing relative Persistence and Excellence of Turf produced after Twelve Months' Weekly Mowing (Type 1 placed at 100).

Method.		Type 1.	Type 2.	Type 3.	Type 4.	Type 5.	Type 6.
Eye estimation	..	100	91	80	55	25	22
Point-quadrat	..	100	86	88	40	32	18

Whatever the method of analysis it will be fairly obvious that the true-perennial rye-grass types are from two to five times as persistent as the Italian and false-perennial types; and the elimination of these latter from the seed trade and substitution by the former types must very rapidly lead to a marked improvement in the rye-grass position in New Zealand. True perennial rye-grass is so fundamental to economic grass-production that every step towards an improvement of existing strains must reflect itself in increased national wealth. The false perennials have no place whatever in the economy of New Zealand grasslands; they have none of the advantages of a good Italian rye-grass on the one hand or of true perennial rye-grass on the other, while they have the disadvantages of both.

Resistance to Disease.

During the year the trials under study have shown that both broad-cast plots and single plants belonging to the various types of rye-grass show marked differences in degree of resistance to rusts which attack both leafage and flowering-stem. From the pasture standpoint leaf-rust

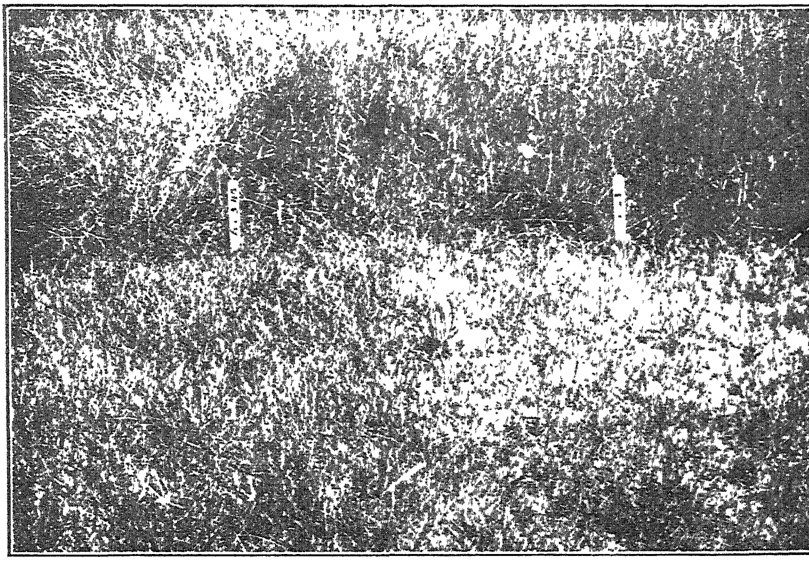

FIG. 10. NEW ZEALAND AND IMPORTED LINES COMPARED: RECOVERY IN FOREGROUND AFTER HAY.

True perennial (Hawke's Bay Type 1) on left; false perennial (imported Types 4 and 5) on right. Cattle series behind labels.

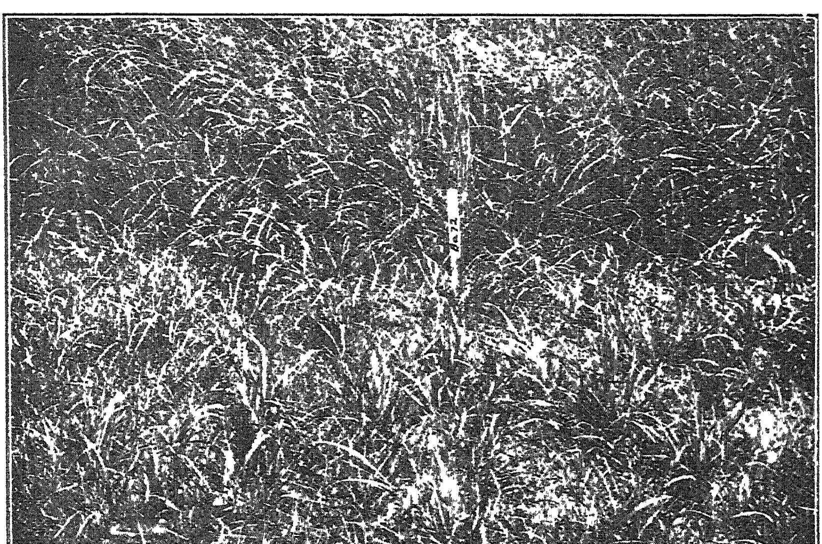

FIG. 11. RECOVERY, AFTER HAY-CUT, OF IRISH "PERENNIAL" RYE-GRASS.

This line is a false perennial (Type 4) containing much Italian. Photo shows good recovery of the Italian and typical poor recovery of the false perennial. This figure and Fig. 10 emphasize the futility of trying to better our rye-grass position by wholesale importations.

[Photos by E. Bruce Levy.

(*Puccinia coronata*) is by far the most devastating in its effect. Stalk-rust (*P. graminis*) attacks the plant very late in the season, and may not be an important economic factor even in seed-production. Without exception during the season under review Type 1—true perennial rye-grass—as well as typical Italian rye-grass, was relatively highly resistant to rust-attack, whereas the false perennials were badly attacked by leaf-rust during the summer. The effect was general, both in the Plant Research Station area tests and in the field experiments, and was most noticeable in spring-sown plots. Table 9 is self-explanatory, and is based on spring-sown broadcast plots at the Plant Research Station on which accurate rust data were obtained.

Table 9.—Relative Rust-resistance of the Main Types

Type			Most resistant at 100.
True perennials	..	..	100
False perennials	..	..	36
Imported seed	..	..	35

It will be noted that imported lines of rye-grass were rather more susceptible to disease-attack than even the false perennials, and this was pretty generally the case throughout the experiments. Even the one or two apparently quite good perennial lines from British seed firms rusted badly under our local conditions. Rust-attack generally appeared early in December and was most severe during January and February. It would appear that rust-attack is closely associated with strain in rye-grass and is relative to the vigour of the type concerned. Just so soon as a type fails to maintain high vigour and stops growing as summer approaches it immediately becomes susceptible to rust. The more vigorous Hawke's Bay strain resists the attack until late in the season, whereas the weaker-constitutioned false-perennial types cease growth early in the season and immediately fall a prey to rust-attack. The production of young leaf well into the summer and as early in the autumn as possible, both by better utilization and stimulation by nitrogenous manuring, seems to be the key-note of success in reducing rust-attack on rye-grass. To accomplish this the use of the more vigorous true-perennial types is the major factor.

PALATABILITY OF RESPECTIVE TYPES.

A criticism of the Hawke's Bay rye-grass strain from the point of view of palatability is strong in the minds of many farmers in the South Island. There is no doubt that the rye-grass types vary in palatability in the early stages of growth, and this is well demonstrated by the results of grazing trials with eighty-five lines at Marton Experimental Area as recorded in Table 10.

Table 10.—Relative Palatability of Rye-grass Types at Eight Months after Sowing. (Most Palatable Type at 100.)

Type 1.	Type 2.	Type 3.	Type 4.	Type 5	Type 6.
51	54	54	79	95	100

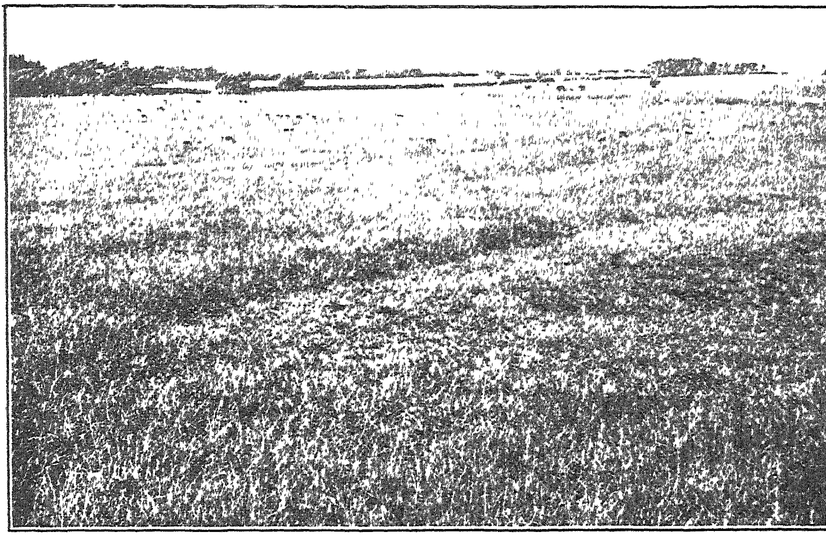

FIG. 12. PALATABILITY OF THE DIFFERENT RYE-GRASS TYPES.

View of grazing trials at Marton Experimental Area. In mid-foreground are two types—Type 6 on right and Type 3 on left In mid-background Hawke's Bay lines, all Type 1, alternate with false-perennial types. In every case, irrespective of origin, the false-perennial annual types are eaten to the ground while the true perennials are less readily eaten.

FIG. 13. PALATABILITY OF THE SEVERAL RYE-GRASS TYPES.

General view of grazing trial, Marton, looking along a series of twenty-four plots of South Canterbury lines sown side by side. In mid-centre, immediately beyond sheep on right, is a Type 3 line approximating to a true perennial. This plot is neglected to the same extent as the Type 1 from Hawke's Bay. The sheep on right is standing on a Type 6 plot which is eaten to the ground; in the immediate foreground are two plots, both Type 4; behind the Type 3 plot is another run of false perennial. These false perennials are eaten almost as well as the true Italian, but are not recovering.

[*Photos by E. Bruce Levy.*

From these figures it will be seen that the straight-out Italian rye-grass (Type 6) is most palatable, and that those of Types 4 and 5—the definite false-perennial types, which presumably have some Italian in their make-up—come next in the relative palatability scale, while the true perennials of Type 1 and the good types of false perennials of Types 2 and 3 fall off considerably in palatability. This was obvious in all the grazing trials undertaken in the field, particularly in the early stages of growth. The true perennials are firmer in the leaf, and apparently are not so palatable as the somewhat quicker-growing, laxer, and broader-leaved types. We concede this point to our critics, but we would like to point out that it is really not a question between the palatability of Hawke's Bay rye-grass and Canterbury or Southland rye-grass, but between one type of rye-grass and another. A true perennial rye-grass from Canterbury or Southland—and there are a few under trial—is neglected by stock in the presence of false-perennial types equally with the Hawke's Bay lines; conversely a dominant Italian rye-grass from Hawke's Bay is equally palatable to the Canterbury or Southland Italian, and much more palatable than the true-perennial types of those districts.

Again, in regard to types, palatability is relative according to the season of the year. Type 1, on recovery after cutting for silage or when the seed-heads are cleaned off during the summer period, throws definitely a greater proportion of leafage rather than stem, whereas the false-perennial and Italian types tend to throw up a second crop of seed-stalks. At this stage the true perennials—throwing young leaf—are highly palatable, and the false perennials—throwing mainly stem—are less palatable.

Selective grazing by stock, again, is relative, and we may get in the same paddock with the same rye-grass type relatively high-palatability patches and low-palatability patches due to stage of growth. If a portion of the paddock is ever so slightly the more palatable—be that due to strain, manuring, utilization, &c.—those slightly more palatable portions under selective (light) grazing will be eaten and the rest of the paddock neglected. If the paddock is now spelled for a few days and stock are returned to it later, the previously sweeter and more palatable portions have made sweet young growth, which is again readily eaten, while the neglected portions have become increasingly unpalatable. Thus utilization under selective grazing may exaggerate as the season advances a degree of palatability slight only at the commencement of grazing. It may be noted here that all the palatability trials have perforce been limited to pastures not older than two years. It is not possible to compare the palatability of old pastures of true perennial rye-grass with those of false perennial, owing to the almost complete disappearance of the false perennial after about eighteen months.

The practical aspect of the palatability controversy that we would like to emphasize is this: so far as New Zealand commercial rye-grass is concerned, if a farmer sows two lines, A and B, in the same paddock side by side, and if the A portion of the paddock is eaten more readily than the B portion, this fact would plainly indicate that two types of rye-grass had been sown and that the A type is in all probability a false-perennial or annually-inclined type, and that the B type is a true

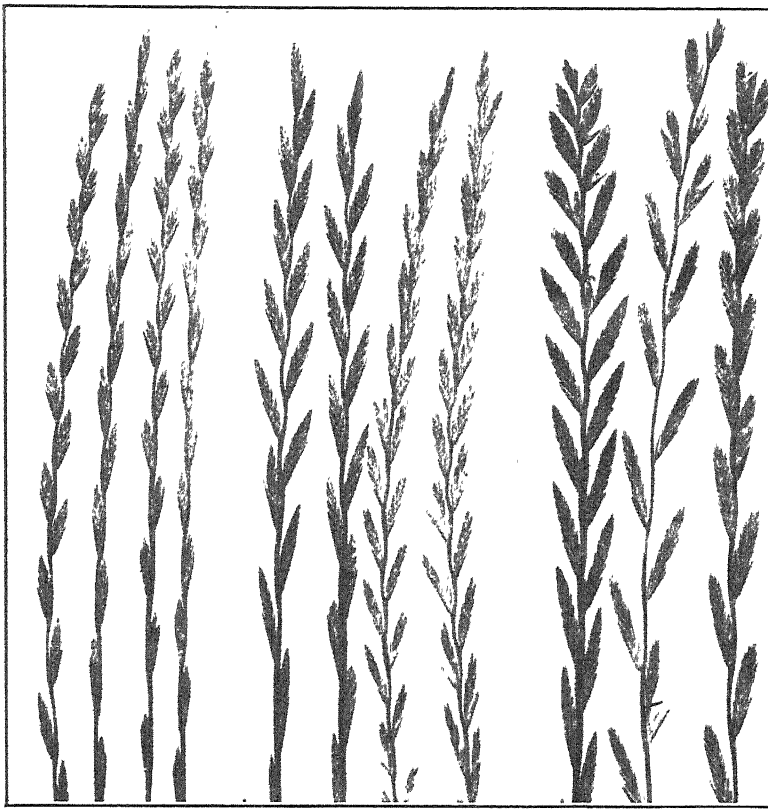

FIG. 14. TYPES OF SEED-HEADS OF THE THREE DOMINANT RYE-GRASS TYPES.
(1) True perennial (left), (2) false perennial (centre), (3) true Italian (right).
[*Photo by E. Bruce Levy.*

perennial and the more persistent type. As Table 10 would indicate, high relative palatability in the initial stages of the pasture-growth points clearly to the wrong type of rye-grass so far as the making of permanent pasture is concerned.

True perennial rye-grass is, after all, a highly palatable and nutritious feed, and one has only to visit the Hawke's Bay and Poverty Bay flats to realize what a boon it would be if those excellent, high-carrying, true-perennial rye-grass swards could be reproduced all over the better soils of New Zealand.

Our thanks are due to Messrs. Madden, Gorman, and Saxby, Assistants in Agrostology, for point-quadrat analysis data and general assistance in regard to these trials. The field staff under Mr. J. W. Todd, Farm Overseer, Plant Research Station, did faithful work in the care of plots and in conducting the mowing trials.

POISONING OF LIVE-STOCK.

SOME COMMON MINERAL AND PLANT POISONS.

C. V. DAYUS, M.R.C.V.S., District Superintendent, Department of Agriculture, Dunedin.

It is by no means an easy matter to clearly define a posion. A common dictionary definition of the word is "that which is noxious to life." Guy states: "A poison is any substance or matter (solid, liquid, or gaseous) which when applied to the body outwardly, or in any way introduced into it, can destroy life by its own inherent qualities without acting mechanically and irrespective of temperature."

But there are many poisons that may do considerable harm without necessarily causing death Lander gives another definition: "A poison is some substance which is acquired by the body in comparatively small amounts with harmful results, sometimes with death as a sequel." Gould's definition is: "A substance that being in solution in the blood or acting chemically on the blood either destroys life or impairs seriously the functions of one or more of its organs."

Strictly speaking, bacterial toxins, snake-venom, &c., are poisons, but it is not intended to attempt to discuss these in this article, which will be confined to the common mineral and plant poisons met with in New Zealand.

The location of the absorption of a poison has a distinct bearing on the degree of its effect. Poisons may be absorbed by any portion of the natural food-tract, by the respiratory tract, or through the skin. The food-tract is the most usual place for absorption to take place, chiefly through the stomach and intestine, on account of the more delicate lining membrane of these parts. As a general rule materials insoluble in water, in dilute acids or dilute alkalis, are not poisonous by the food-tract. This fact is observed in the selection of antidotal treatment, when materials are often given for the reason that they tend to render the specific poison less soluble.

Soluble poisons are easily absorbed by the respiratory tract, which is a very suitable channel if they acquire contact with it. The intact skin is generally an effective barrier against absorption, but the broken skin, such as small abrasions, wounds, &c., is quite a different matter The appreciation of this point is an essential one on account of the extensive use in New Zealand of dipping and spraying fluids for lice and ticks. The majority of such fluids are roughly solutions of arsenical preparations or coal-tar derivatives with the addition of an alkali.

The addition of an alkali, while essential for the effective operation of the dip or spray fluids, also increases the penetrative powers of arsenic and phenols, and this is especially so if the solution is too strong. The reason for this addition is that the alkali saponifies and emulsifies the fatty nature of the normal skin secretion—that is, it converts it into a soapy emulsion.

If a poison does not actually destroy tissue and cause death by shock it does not exercise its effect until it has entered the general circulation. By this means it has to pass the natural barriers — the

liver and lungs. The liver arrests most metallic poisons and many alkaloids. An alkaloid is a nitrogenous compound occurring in plants, and generally the active principle. Many poisons, notably metallic poisons, since they are arrested in the liver are cumulative. But following the absorption of most poisons elimination is more or less rapidly commenced by the excretory channels of the body.

The well-known maxim "What is one man's food is another man's poison" serves to emphasize the rather important question of tolerance. In the case of some poisons an immunity may develop as the result of repeated small doses. Then there is the variation of tolerance in the different species to the same poison. For example, the ox is more sensitive to lead than the horse, but generally speaking the ruminant animal is more resistant to poisoning than the horse, dog, and cat. The action of morphia is well known: it induces stupor. In the cat, however, it has the exact opposite effect—an idiosyncracy not easily explained.

Poisons are roughly divided into the following classes:—

(1) Corrosives, such as the strong mineral acids, caustic soda, perchloride of mercury, carbolic acid in strong solution, &c. They act by actual destruction of the living cell.

(2) Irritants, such as arsenious acid (white arsenic), acetate of lead (sugar of lead), subacetate of copper (verdigris), sulphate of copper (blue vitriol, bluestone), silver nitrate (lunar caustic), bichromate of potassium, aloes, croton oil, &c., producing vomiting, delirium, &c.

(3) Narcotics: Drugs producing stupor, mostly drawn from the vegetable kingdom, such as opium, hydrocyanic acid (prussic acid), alcohol, chloroform, ether, chloral, &c.

(4) Narcotic irritants, forming a very large class, such as strychnine, foxglove, saffron, deadly nightshade, tobacco, yew, &c.

The poisoning of animals is generally brought about by their acquiring the poison by means of food and water, and occasionally through the broken skin. Cases of arsenical poisoning have occurred through dipping and spraying in both cattle and sheep. The fluid may have been allowed to drip from the animals and so contaminate foodstuff. Again, the directions on the makers' containers may not have been strictly adhered to. Poisoning of cattle has followed spraying them with some sheep-dips, in spite of the fact that the directions have specifically stated that on no account must the fluid be used for dipping or spraying cattle, horses, or dogs.

It must be borne in mind that sheep-dip solutions are as a rule much stronger than similar solutions used for cattle, horses, or dogs. This is so on account of the necessary penetration of the wool, and is possible with no attendant danger because sheep do not lick themselves. The majority of cases of mortality after dipping are due to defects in the process, including the following: (1) The dip is not made up according to the accepted strength as advised by the makers; (2) the dip is not stirred properly; (3) sheep are put through too quickly; (4) too long immersion; (5) sheep are driven before dipping or too soon afterwards, or dipped on a full stomach.

It is necessary to exercise great caution with dipping-fluids, as they are all poisonous; the trade designation "non-poisonous" applied to

some fluids is a fallacy. Many of the well-known proprietary dips are of standard uniform strength, are in universal use, and every safeguard is taken against any danger attendant upon their use, providing strict attention is paid to the directions, and the method of procedure carried out judiciously and correctly.

Lead poisoning is by no means uncommon, due to animals having access to freshly painted structures, and through old paint-tins and white-lead containers not being carefully disposed of. Cattle are notoriously inquisitive, and paint seems to have some added attraction for them. Lead shot from opened cartridge-cases has also been known to be responsible for poisoning

The use of poisons to control vermin, notably those containing strychnine and phosphorus, accounts for some cases of poisoning of domestic animals. Caustic soda for cleaning dairy utensils has accounted for mortality, notably in pigs.

One of the commonest plant poisons is ragwort, due to continuous ingestion of the plant in districts where the natural pasture is extensively invaded by it. Another is tutu, which is not readily eaten unless the animal is suffering some degree of starvation—for instance, after being driven. A further instance is buttercup poisoning. Careless disposal of clippings from garden shrubs and plants is a source of trouble sometimes; they should always be regarded as unsafe Poisoning from this source may be due to laurels, rhododendron, laburnum, yew, &c.

The amount of poison acquired naturally regulates the course which follows, and poisoning may be acute or chronic with possible intermediate degrees. In acute poisoning the symptoms are quickly noticeable and intense, with a rapid course and early termination. In chronic poisoning the result is produced by the cumulative effect of repeated doses, as, for example, in ragwort poisoning, though as a general rule cases of chronic poisoning are not common in animals.

SOME OF THE COMMON POISONS.

Lead.—The source of lead has already been indicated. An oxide of lead commonly known as red-lead is used in painting and plumbing. A basic carbonate known as white-lead is used as a pigment. The cases of poisoning met with are commonly in cattle. The main symptoms of acute lead poisoning are gastro-enteritis, derangement of the nervous system, twitchings and convulsions, salivation and nasal discharge, and later blindness—an animal will stumble into any available obstacle; temperature nearly normal or below normal; coldness of the extremities, followed frequently by collapse, coma, and death.

In chronic lead poisoning, called "plumbism," in the human subject, which is of rare occurrence in animals, a characteristic blue line appears on the gums, with general digestive derangement. In cattle evidence of paint is frequently found after death in the third stomach, commonly known as the "book" or "bible." In treatment the primary step must be to stop the source of supply. Epsom or Glauber salts should be given; these are the sulphate of magnesium and sodium respectively, and by chemical action either tends to form lead sulphate,

which is insoluble. Bulk doses of tea or coffee with milk should then be given and the animal kept warm.

Arsenic.—In dipping-fluids the alkali arsenite employed is generally sodium arsenite, which is easily soluble and the most poisonous of the ordinary arsenical preparations. The general symptoms of arsenical poisoning are salivation, thirst, colic, and a subnormal temperature with trembling, stupor, and convulsions Death takes place sometimes very rapidly. There is a very marked stiffness in movement almost amounting to paralysis, especially of the hind limbs. Often portions of the skin assume a characteristic purply - blue colour, especially noticeable round the udder in a cow; later this area may undergo sloughing. This is comparable to arsenical eruption noted in man.

The chemical antidote is freshly prepared ferric hydroxide (an iron compound). In addition milk, white of egg, and lime-water in large quantities are useful.

Phosphorus.—Yellow phosphorus is the form met with in vermin-poisons. In New Zealand it is used in the manufacture of phosphorized pollard for rabbit-destruction. A peculiarity is that symptoms may be delayed some hours, even days after taking, as it is slowly absorbed. The symptoms are those of intense thirst and abdominal pain. Possibly the breath may be luminous in the dark. In pigs I have found free phosphorus in the stomach-contents several hours after death. Bluestone is given as an antidote, it being supposed to remove the poison in the form of copper phosphide. In phosphorus poisoning any oils, milk, or anything of a fatty nature should be carefully avoided.

Strychnine.—Strychnine is one of the two chief alkaloids of the seeds of *Strychnos nux vomica*, an East Indian tree. The prepared drug is a white crystalline substance having an intensely bitter taste. It is extensively used in medicine as a tonic. Employed in New Zealand as a rabbit-poison.

Poisoning cases occur mostly in small animals, particularly dogs, but strychnine is also a source of danger to sheep and the larger animals. It acts on the central nervous system, and produces convulsive seizures followed by a period of relaxation. The symptoms are similar to those of lockjaw. Two or three grains would be sufficient to poison a sheep, and slightly less than half a grain to poison a dog.

In the case of a dog an emetic should be given. The best physiological antidote is choral hydrate. Others are tobacco and permanganate of potash. Needless to say any attempt to antidotal treatment must be carried out rapidly.

Ragwort.—This poisoning is due to stock eating the common species of ragwort (*Senecio Jacobaea*) found in this country. It is the cause of so-called Winton disease in New Zealand, Pictou disease in Canada, and Molteno disease in South Africa. It is worthy of note that the major portion of the original investigation work into the poisonous effects of ragwort was carried out in New Zealand by Dr. J. A. Gilruth. As is well known, many areas of this country are badly overrun with the weed, and losses of stock due to its cause are by no means uncommon in those districts.

Ragwort poisoning has occurred in horses, cattle, and sheep, and roughly that is also the order of susceptibility. The plant contains

one or more poisonous alkaloids, whose chief function is to produce a slow chronic reaction in the liver, rendering that organ what is technically known as cirrhotic. Actually, instead of being friable the liver becomes paler than normal in colour, and hard. This is due to the destruction of true liver-cells and their replacement by coarse white fibrous tissue—a condition similar to that occurring in man in chronic alcoholic poisoning.

Having regard to the chronic nature of the condition, it will be easily realized that the process of liver-destruction has reached a fairly advanced stage before symptoms are shown by the animal. That the toxic principles are operative long after the ragwort has ceased to be a portion of the diet is frequently evident in many cases noted, often where an interval of three or four months must have elapsed before the first appearance of symptoms. Curative treatment is therefore practically out of the question. Symptoms appear gradually: affected animals become dull and lose condition; later the gait becomes staggery, and there is often a tendency to fall into obstacles—a period of intoxication. They gradually drift into a hopeless condition of semi-consciousness, eventually falling down and becoming unable to rise, and so death takes place.

Sheep appear to be more resistant than horses and cattle, but they also cannot be permitted to ingest ragwort indefinitely. They are often used successfully for keeping down the growth, and for this purpose it is most suitable to stock them heavily on ragwort-infested pasture in the spring. If sheep have been on ragwort too long without a change deaths may take place quite suddenly; these are notably increased if such sheep are driven distances. A condition of jaundice is often noticed during life, though not always, but there is considerable tendency for the carcass to assume a yellow appearance after death. This is due to the absorption of bile, and has nothing whatever to do with the fact that ragwort has a yellow flower, as is sometimes popularly supposed.

In consequence of the general hopelessness of individual treatment, work should be concentrated on means of effective control if not complete eradication of the ragwort. This must be an accomplished fact before poisoning from this cause will cease altogether.

Tutu.—This shrub (*Coriaria ruscifolia*) is commonly seen in the bush and on hillsides and banks in many parts of this country. As a rule stock do not eat tutu unless there is a shortage of natural feed. Poisoning is often noted after stock have been driven and then eaten the shrub on empty stomachs. The symptoms are those of excitement, with unsteady gait and nervous twitchings, and the animal is frequently blown. If discovered alive treatment is possible by relieving the blown condition by puncturing. Suitable medicinal treatment is the administration of 1 oz. of carbonate of ammonia dissolved in thin oatmeal gruel.

GENERAL.

There are a few other causes of poisoning of less importance, but space will not permit a detailed description of them here. Many of the types of symptoms are common to more than one

kind of poison, and it is sometimes difficult to diagnose a case specifically as being due to poisoning or not. But careful consideration of the points touched on should be a helpful means of avoiding errors and provide stimulation to greater powers of observation

NOTE.—For detailed information regarding the indigenous plant poisons, a series of articles in the *Journal* entitled "The Poisonous and Suspected Plants of New Zealand" by B. C. Aston, may be referred to. The articles appeared in Volumes 16 (p. 324), 17 (p. 6), and 26 (pp. 78, 140, 230).—ED.

PLANNING OF THE TEST-ROOM AT DAIRY FACTORIES.

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THE writer has noticed in the course of his official travelling that in quite a number of comparatively new factories little thought has been given to the position or convenience of the test-room, especially to its lay-out. In the case of cheese-factories the tester has been placed on the open stage without hot or cold water nearer than the making-room, and where the operator has no control over temperatures, &c. In other cases the test-room has little or no drainage or is in conjunction with the starter-room, which is also in a bad position.

All test-rooms should have a suitable bath installed to read the tests from. This should have a steam-inlet to regulate temperature, and an overflow $5\frac{3}{4}$ in. from the bottom to ensure that the bottles cannot be submerged. Testers should be on a solid foundation, level concrete being the most satisfactory. If the concrete block is recessed this will provide a suitable cool and convenient place in which to keep the jar of acid that is in use. All test-rooms should be provided with an abundance of light.

Testing being a very important phase of the factory routine, the operator should have a test-room that is conducive to accuracy with the minimum of inconvenience. In the case of butter-factories the test-room should be as far as possible from churns, engines, &c., owing to vibration retarding or interfering with the sensitiveness of the delicate cream scales. If possible it is advisable to detach the test-room from the main building. With test-rooms of this description the operators find it better to carry the samples a greater distance than have their work retarded by noise of can-steaming, vibration of machinery, and incoming and outgoing of staff. It is not desirable that test-rooms be in conjunction with store-rooms, offices, &c.

It has been common in the past to place the tester in the corner of the test-room. This should be discouraged, owing to the small steam-pipes and nipples having to be replaced periodically. This work is much easier when the tester is in a central position, and in most cases it would be in a better light.

A satisfactory lay-out for the test-room from left to right is: (1) Sample-heating tubs; (2) scales; (3) burette for acid; (4) tester (central position); (5) hot-water bath; (6) washing-up tub, and rack for wet bottles. Composite sample-bottles, after washing, can be stored on shelf under bench away from light and in a cool position.

THE PURCHASE OF FERTILIZERS.

MEANING AND USE OF THE INVOICE CERTIFICATE.

F. T. LEIGHTON, Analyst, Chemistry Section, Department of Agriculture.

THE Fertilizers Act of 1927 provides that, for the information and guidance of the buyer, the seller of 5 cwt. or more of any fertilizer shall supply an invoice certificate setting out the nature and composition of the fertilizer and the percentage of each of the three recognized fertilizer-constituents—nitrogen, phosphoric acid, and potash. In framing legal measures it is necessary, in order that there shall be no ambiguity, to make use of certain scientific and technical terms the meaning of which is sometimes not understood clearly by the layman. Some questions that are frequently asked by farmers regarding the meaning of statements in fertilizer invoice certificates are dealt with in the following matter.

The invoice certificate states the name and brand of the fertilizer; the percentages of the fertilizer-ingredients nitrogen, phosphoric acid, and potash, and their solubility in water; the nature and proportion of each of the components of a mixed fertilizer, including any filler or diluent; and the fineness of grinding in the case of basic slag or rock phosphate. In certificates for basic slag and ground rock phosphate the seller may also state the percentage of phosphoric acid soluble in citric acid by the standard method of extraction. This, however, is optional, and since the invoice certificate is of the nature of a guarantee of quality by the seller this figure is very frequently omitted.

In the case of phosphates of any kind the essential ingredient is entered in the invoice certificate as phosphoric acid. In trade practice there is, unfortunately, a confusion of terms in respect to phosphatic fertilizers. The grade of superphosphate and of phosphatic guano is usually advertised, and branded on the bags, in terms of tricalcic phosphate (for instance, 44–46 per cent. superphosphate, 60–63 per cent. guano); while other fertilizers, such as basic slag, are graded in terms of phosphoric-acid content. One part of phosphoric acid is equivalent to approximately two and one-fifth parts of tricalcic phosphate. It will now be clear why, when buying 44–46 per cent. superphosphate, the farmer receives an invoice certificate showing it to contain about 21 per cent. of phosphoric acid. If basic slag were graded in the same way, a 17–20 per cent. slag would be sold as of 37–43 per cent. quality. In order to minimize this confusion of terms as far as possible the Fertilizers Act requires the quality of phosphatic fertilizers to be stated in the invoice certificate in terms of phosphoric acid only.

The statement of components in the invoice certificate is straightforward, and calls for little comment. It tells the buyer in just what form each of the ingredients of the fertilizer has been added; whether, for instance, the soluble nitrogen is there as nitrate of soda or as sulphate of ammonia, the phosphoric acid as bone phosphate or ground rock phosphate, &c. It also informs him what, if any, filler has been added, and in what amount. A filler or diluent is any substance, other than a fertilizer, that is added to a fertilizer or mixture of fertilizers. A filler, however, is not necessarily an adulterant. Such a substance

as carbonate of lime may be used to improve the mechanical condition of the mixture and enable it to run easily through the drill. Occasionally excessive amounts of filler are used, mixtures containing about half their weight of ground limestone have come under notice, the percentages of the active fertilizer ingredients being, of course, proportionately reduced. On the other hand, some manufacturers use no fillers in their mixtures, the desired granularity being obtained by using suitable proportions of ground rock phosphate, or by other means.

The fineness of grinding of basic slag and ground rock phosphate is shown in the invoice certificate, the figure indicating the percentage of the fertilizer that will pass through a standard sieve having 10,000 holes to the square inch. A minimum fineness of 80 per cent. is required by the Fertilizers Act regulations.

STATEMENT OF SOLUBILITY.

Figures indicating the solubility of fertilizer ingredients appear to perplex many farmers. The solubility of nitrogenous fertilizers is not difficult to understand; such fertilizers as nitrate of soda and sulphate of ammonia contain water-soluble nitrogen, while the nitrogen of animal fertilizers is in the insoluble form. Generally no alteration in solubility occurs when nitrogenous fertilizers are used in mixtures (the addition of lime, however, will result in the loss of nitrogen from ammonia compounds and animal fertilizers). In the case of potassic fertilizers, only water-soluble potash compounds are recognized as fertilizers, and these also do not alter in solubility when incorporated in the usual mixtures. Phosphoric acid may be recorded in the invoice certificate as soluble in water, insoluble in water, or soluble in citric acid. The usual source of water-soluble phosphoric acid is superphosphate, although some of the new concentrated fertilizers contain soluble compounds of phosphoric acid with nitrogen or potash.

It is sometimes asked why an invoice certificate of a mixed fertilizer shows little or no water-soluble phosphoric acid, although the statement of components shows that a fair amount of superphosphate is present. The reason is that the water-soluble phosphate changes (reverts) more or less to a form that is insoluble in water but is still easily soluble in weak acids and is readily accessible to the plant. The well-known basic superphosphate is an instance of the water-soluble phosphate being reverted deliberately, by the addition of lime. Since this reversion of soluble phosphoric acid goes on slowly from the time the fertilizer is mixed, the manufacturer in his invoice certificate allows for the maximum reversion that is likely to take place, and records the soluble phosphoric acid on the low side. Actually, unless lime has been used as filler, there is not usually much reversion if the fertilizer is used reasonably soon after mixing.

The solubility in citric-acid solution (citric solubility) is the cause of considerable confusion of mind, on account of the practice of some sellers of quoting figures showing the citric solubility of their fertilizers by "modified" methods. Citric solubility is determined by shaking for a definite time a mixture of definite quantities of fertilizer, citric acid, and water. By varying the respective quantities and the time of solution, varying degrees of solubility can be obtained. It is necessary, therefore, to have a standard method of procedure in order that solubility results may be compared. The Fertilizers Act regulations

prescribe the official method, and it is provided that when the citric solubility of a fertilizer is included in the statement of analysis (invoice certificate) it shall be determined by the official method. Therefore, when fertilizers are advertised as of high citric-solubility by a modified method, it should be understood that the solubility figure cannot be included in the invoice certificate, and that no action can be taken under the Fertilizers Act in respect to any guarantee of quality that is not incorporated in the certificate.

The citric-solubility test was devised for the valuation of basic slag, and it is still of considerable use in estimating the probable comparative values of different slags. With the development of the sale of finely ground rock phosphates in competition with basic slag it was found that the official method as applied to slag gave results which, it was claimed, did not truly represent the comparative availability of the phosphates. Several modified methods of extraction were proposed, some using a very small amount of fertilizer to a very large amount of weak citric-acid solution, others making use of other weak acid solvents. The effect was to increase the solubility of the phosphoric acid from two to seven or eight times that obtained by the standard method. As these methods have not so far definitely been proved to give a reliable indication of availability they have not been recognized by the Fertilizers Act.

The solubility of basic slag and rock phosphate is in general influenced to a considerable extent by the fineness of grinding of the fertilizer, and, with the modern methods of grinding phosphate rock, fertilizers are obtainable which give a fairly high solubility by the official method.

Unit Values.

The Fertilizers Act no longer requires the "unit values" of fertilizer ingredients to be stated, but as this system of valuation is still made use of for advertising purposes (and in the trade as a basis of purchase) a short explanation of the method may be useful.

A "unit" of a fertilizer ingredient is 1 per cent. of 1 ton (that is, 22·4 lb.). Basic slag containing 17 per cent. of phosphoric acid contains 17 units of that ingredient, and if the price is £5 per ton the price per unit (unit value) will be £5 ÷ 17, or 5s. 11d. This system makes it easy to compare different quotations for the same kind of fertilizer where the quality and price both vary. Suppose, for example, that two lines of basic slag are under offer:—

A is quoted at £5 per ton for 17–20 per cent quality.
B is quoted at £5 12s. 6d. per ton for 20–22 per cent quality
Then the unit price of A is found to be 5s. 11d. while that of B is 5s 7d.

Assuming that the solubility and fineness of grinding are approximately equal, it is clear that the higher-priced fertilizer is cheaper by 4d. per unit than that which is offered at the lower price per ton. Similarly the cost of mixed fertilizers can be compared by assigning the current unit value to each constituent and multiplying each percentage by its unit value.

The mistake should not be made of attempting to compare the unit values of unlike fertilizers. Comparisons are sometimes made between the unit values of such widely different types of phosphate as superphosphate, basic slag, and raw rock phosphate. No useful information can be obtained in this manner.

RURAL FINANCE IN NEW ZEALAND.

THE INTERMEDIATE CREDIT SYSTEM AND LONG-TERM ADVANCES

Paper presented by J. J. ESSON, C.M.G., Chairman, Rural Intermediate Credit Board, to the Empire Farmers' Conference, held at Wellington, 24th March, 1930.

THERE is probably no country in the world where better provision exists in the credit system for primary producers than in New Zealand, both as regards short-term and long-term loans, or where greater opportunities are afforded the industrious farmer with small capital. I say "small capital" advisedly, for whilst personal ability, character, and experience are essential, it is imperative that the farmer himself should contribute a certain amount of the capital required in his business. It is the only buffer between his creditors and loss, and he should constantly endeavour to maintain his equity unimpaired, for when "sailing too close to the wind" he is in serious trouble directly prices fall.

In recent years there has been a large increase in the number of lending institutions, which has not been an unmixed blessing. Credit has its disadvantages as well as its advantages, for when it is too easily obtained it becomes a temptation to overspend and to borrow injudiciously. Indeed, our experience has shown that in the past credit was often too easily obtained, and money was borrowed without due regard to its profitable employment. Values were much inflated during an abnormal period of high prices. Land was bought at impossible prices, stocked and cultivated on credit by farmers, many of whom added to an overwhelming liability by the purchase of costly machines, motor-cars, and suchlike on the instalment plan.

New Zealand is still recovering from that stage; and although a liberal lending policy is observed, that liberality is checked when the applicant, although he may be a good moral risk, is burdened with liabilities and charges which cannot possibly be met out of the income of his farm, or when it is sought to be taken advantage of to cover personal extravagance, negligence, or speculation in land and stock instead of practical occupational farming.

There is less room to-day in the rural credit system for the speculator, who regards farming as an opportunity, not as an occupation, and it is becoming understood that the true value of land is not found in its selling-price but in its productivity, its lasting-qualities, and average annual return, or that its earning-power determines its loan value.

Here as elsewhere there is the same urgent demand for credit in periods of adversity, when it is sought as a desperate remedy; but no institution, whether State or co-operative, can afford to make loans which prudent investors would reject as hazardous and excessive. Every effort is, and should be, made to foster our primary industries and to improve the conditions and prospects of those upon the land, but it has to be recognized that unlimited credit will not help farmers when unprofitable prices prevail, for it would only be adding to their burden

of liabilities. It is an axiom that cheap money cannot restore price-levels. The only consideration must be how much credit can be profitably employed or be profitable for the farmer to borrow.

The main sources from which the New Zealand producer obtains credit are (1) the commercial banks; (2) private companies, stock and station agencies, &c.; (3) State or State-fostered organizations. For short-term loans the two former have rendered and continue to render great assistance to the primary producers; in fact, they have established "a service which through long usage and custom has become almost indispensable," and, considering the cost of supervision and the risk run generally, their interest rates are not unduly high.

Time, however, will only permit me to give a general outline of the State and State-fostered organizations, which are obviously designed to benefit the small farmer rather than the larger landholder. The latter can usually finance on reasonable terms; for instance, one of our leading commercial banks recently instituted a long-term reducible mortgage, an example which is being followed by other large lending institutions

Long-term Advances.

The State Advances system, providing for long-term loans on farm lands on the amortization plan, was created by the Government Advances to Settlers Act, 1894, under which a Government Advances to Settlers Office was established. Its purpose was to assist agricultural development by providing capital for settlers at reasonable rates of interest. The preamble to the Act read as follows: "Whereas by reason of the high rates of interest charged on mortgages on land, and the heavy incidental expenses connected therewith, settlers are heavily burdened and the progress of the colony is much retarded: And whereas it is expedient that the Government should afford such relief in the premises as is consistent with the public safety: Be it therefore enacted," &c, &c

The new Department was authorized to make loans not exceeding £2,500 to individual borrowers on three-fifths of the value of freehold land, and up to one-half of the borrower's interest in leasehold land. The loans were repayable over a term of thirty-six and a half years. Loan funds were to be provided by the sale of Government debentures or stock, which nominally increased the public debt of the Dominion but against which the first mortgages held by the Advances Office provided an ample set-off.

It is hardly necessary to stress the advantage possessed by this method of finance when compared with the old way of borrowing on a flat mortgage for five, seven, or ten years, which made it very hard for the farmer, who during periods of financial stringency sometimes lost his farm because he could not get his loan renewed.

Amortization worked wonders for the settler who secured a State Advances Office loan. He was relieved of the fear of foreclosure, and the reduced interest lightened the drag upon his income. The expense of renewing his mortgage every few years no longer had to be met, while the right to repay the whole or practically any portion of the loan at any time placed him in an even more favourable position. Added to all this is the fact that he is steadily year by year improving his position in the way of reducing his capital liability by regular payments

which are not sufficiently large to be burdensome The operation of the Act has also benefited farmers who are not borrowers from the State Advances Office, because shortly after it became law the interest rates charged by other agencies were materially reduced.

The fear was expressed that the State would in time become the sole mortgagee, but this has proved groundless so far as the farming community is concerned. The State systems have proved regulative rather than competitive, as the bulk of the farmers continue their old business connections, but certainly under more favourable terms.

To bring the Act into operation arrangements were made for a loan of £1,500,000, and such was the demand that at the end of 1928–29 the amount owing to the Settlers Branch on mortgages on rural lands was £12,958,433. Under the Rural Advances Act of 1926, which further extended the facilities to farmers, an additional amount of £1,875,285 had been advanced up to the end of the financial year 1928–29

Since the inception of the Act there have been various amendments with a view to making its benefits available to as many farmers as possible. The legislation is now embodied in the State Advances Act of 1913 and its amendments, also the Rural Advances Act of 1926, which constituted a fresh branch of the Advances Office. The Rural Advances Act was passed following the report of a Royal Commission on Rural Credits which was appointed in 1925 to investigate the system of rural credit in different countries.

At present the maximum advance which may be made to any applicant is £3,500 under the Advances to Settlers Branch and £5,500 under the Rural Advances Branch, the margin of security required being 25 per cent. under the former and $33\frac{1}{3}$ per cent. under the latter. Loans may be granted for twenty years, thirty years, or thirty-six and a half years. The example set by the Legislature has been followed by other lending agencies, and a considerable portion of the money now advanced by other Government Departments and outside financial institutions is loaned on long-term mortgages repayable by instalments.

Funds for the Rural Advances Branch are obtained by the sale of bonds secured upon the collective mortgages, but as both interest and principal are repayable to lenders out of the Consolidated Fund they are to all intents and purposes instruments of State.

Intermediate Credit.

In addition to the system of long-term credit provided by the State Advances and Rural Advances Acts, further effect was given to the recommendations of the Royal Commission, already referred to, by the Rural Intermediate Credit Act, 1927. Briefly, intermediate credit is credit given for a longer period than is contemplated in commercial transactions and of shorter duration than the usual mortgage term. It enables the producer to meet his seasonal requirements without embarrassment, as it covers farm credit for periods ranging from six months to five years, and is secured upon farming stock and chattels, and non-perishable farm products.

The State Advances Amendment Act of 1922 contained authority for advances up to £500 on the security of farm stock and chattels, but its administration was centralized in Wellington, and in the absence

of local machinery it was not availed of to any great extent. Another provision, the Rural Credit Associations Act, in the same year, empowered farmers to join together for the purpose of securing accommodation upon their available assets with a joint-and-several liability. This was fatal in itself, and as no central organization was set up to provide funds for investment upon the members' securities no associations were formed.

The burden of financing the primary producers in the development of their holdings and during the periods of low prices thus devolved upon the banks and the stock and station agencies, whose action in providing what was in effect a system of intermediate credit was really outside their essential activities and anything but a profitable part of their business.

The outstanding feature until recent years was the lack of a central organization for attracting a flow of capital for investment in farm securities. In New Zealand, as in other parts of the world, secondary industries, commercial and business undertakings of all kinds, had through the development of the joint-stock company form of enterprise absorbed in constantly increasing extent the savings of the community, and primary industry suffered in consequence. Experiences during the recurring periods of low prices in connection with investments upon individual farm units had also tended to weaken confidence. It was evident that some steps were urgently required to organize and co-ordinate farm credit in order to make it attractive to those who wished to lend money at a reasonable rate on proper security, and to provide a loan currency which would conform to the requirements of seasonal production.

The Act of 1927 was the outcome, and one of its prime objects was to restore the confidence of investors and thus secure a flow of capital for investment upon rural securities, such as stock, produce and other chattels at reasonable rates of interest.

The administration of the system is entrusted to an independent Board of eight members three of whom are statutory—namely, the Financial Adviser to the Government, the Superintendent of State Advances, and the Public Trustee, who is the Commissioner of Rural Intermediate Credit; the remainder are appointed by the Governor-General in Council, and consist of practical farmers and men with long experience of New Zealand banking finance, and merchandizing. Sixteen subsidiary or district boards, consisting of five members each, have been appointed by the central Board. The District Intermediate Credit Supervisors in each district act as the local representatives of the central Board and are *ipso facto* members of their respective district boards. The boards are fully representative of the various classes of the community interested in rural finance. The detail work is carried out by the Public Trust Office organization as agent for the Board, and the branch officers of the Public Trust Office throughout the Dominion act as the local representatives of the Board, those in the more important centres acting under the designation of District Intermediate Credit Supervisor, with definite statutory powers and duties.

FINANCE.

Initial funds for investment by the Rural Intermediate Credit Board were provided by an advance of £400,000 from the Consolidated Fund

free of interest for the first ten years, one-third to be placed to the credit of a special redemption fund for the purpose of redeeming debentures issued by the Board, and the remaining two-thirds to be available for making advances as permitted by the Act. Grants were also made to the Board up to a total of £10,000 to cover the expenses of establishment and the preliminary cost of administration. The permanent and main source of the Board's funds for investment will be the issue to the public of debentures secured upon its assets and by the provisions of the Rural Intermediate Credit Act of 1927. These debentures will, in effect, have priority over the claims of the Crown to repayment of the advance of £400,000, as repayments to the Crown are restricted so that they may not exceed in total the amounts transferred to the reserve accounts of the Board. The total of the debentures issued by the Board may not at any time exceed the sum total of the advance from the Consolidated Fund and the amount of the investments of the Board, or the sum of £5,000,000, whichever is the less

Methods of Loans by the Board.

The funds provided are made available to the farming community by four methods, providing ample scope for co-operative effort upon the part of farmers in relation to their credit requirements.

Associations.

The first of these methods is by advance to farmers as members of a special form of limited-liability company known as co-operative rural intermediate credit associations. The Act enables farmers to combine for the purpose of financing themselves as individuals on their collective financial strength, as a group. The procedure briefly is for a group of farmers of not less than twenty in number to form an association, and the Board is authorized to advance funds to the association, to be loaned by the association to its members upon approved securities. Farmers who subsequently desire to apply for loans through the association may be admitted as members, and members who have repaid their loans, or do not propose to lodge applications, may be permitted by the directors to retire and may receive the agreed value of their shares, provided that their retirement will not reduce the membership of the association below the statutory minimum.

The minimum share capital which a member must contribute is twenty-five £1 shares, and a shareholding of this amount will permit a member obtaining a loan up to £250 if his security is considered sufficient. A member desirous of obtaining a larger loan must take up shares to the nominal value of one-tenth of the amount of the loan, and consequently a member's shareholding may range from £25 up to £200 in the case of the maximum loan of £2,000. Members of associations are not liable for the loans obtained by other members beyond the amount of the share capital which they have subscribed.

Associations are not intended to be trading bodies or profit-making concerns, and are subject to certain statutory restrictions imposing safeguards considered necessary by reason of the fact that they will mainly be debtors of the Board, which in turn is trustee for the debenture-holders who have invested their funds in the Board's business, and for the Crown in respect of funds advanced on loan from the Consolidated Fund. On the other hand, it has been possible to

exempt the associations from charges levied in the case of commercial companies, and the procedure with regard to their formation and working is much simplified. The Board may also make advances to associations up to £25 each to meet the preliminary expenses incurred in their formation. Such advances are made by way of loan free of interest for periods up to ten years.

The maximum amount of loans which may be granted to members of associations was fixed by the Rural Intermediate Credit Act of 1927 at £1,000, but by an amending Act in 1929 the limit was increased to £2,000. The purposes for which loans may be granted are defined by the Act, and include mainly the improvement of the farm property (including the erection of buildings), the purchase of implements, stock, seeds, and similar farm requirements, the payment of mortgages, debts, or other liabilities incurred in relation to farming operations, and generally any such purposes approved by the Board The Act also provides that loans should be granted on a reducing basis, the instalments being fixed by the Board to suit the requirements of the various classes of loans. The Board has fixed its interest-rate at 6½ per cent. per annum, and this rate is charged upon the daily balance of the loan accounts. The securities taken are mainly mortgages of farming stock and chattels with, in suitable cases, collateral security over the farm properties.

Up to the present twenty-eight co-operative rural intermediate credit associations have been formed in various parts of the Dominion, thus providing farmers in a large number of districts with the opportunity of approaching the Board for loans upon their live-stock and chattels and other farming assets. Up to the present associations have been formed mainly in dairy-farming districts, but with the recent increase of the limit for loans, and the introduction by the Board of a new system for advances in connection with sheep and grain securities, increased activity in the formation of associations in sheep-farming districts is anticipated.

LOANS DIRECT TO FARMERS.

The provision for loans direct by the Board to farmers did not appear in the Bill originally submitted to Parliament providing for an intermediate credit system, but were introduced by a special parliamentary committee set up to consider the Bill, and on which farming interests were extensively represented. These provisions enable a farmer to apply direct to the Board for an advance, provided he is able to arrange a guarantee satisfactory to the Board for such amount as may be required by it, being not less in any case than 20 per cent. of the original amount of the loan, the collateral security afforded by this guarantee replacing the collective responsibility of an association for advances made by the Board to its members. The addition of this alternative method provided for the development and extension, with adequate safeguards, of the existing facilities under which loans on chattel securities could be obtained under the State Advances system.

The conditions with regard to the maximum amount of loans, the purposes for which loans may be granted, the rate of interest chargeable, and the repayment of the loans which have been set out in regard to association loans apply to direct loans granted by the Board. The securities are generally of the same nature as those taken in connection with association loans, with the additional security of a guarantee as required by the legislation.

Most of the loans issued by the Board direct to farmers have been granted with the guarantees of dairy companies — co-operative and proprietary. Up to the present forty-nine companies have made arrangements with the Board for the acceptance of their guarantees of loans. The bulk of these companies are co-operative dairy companies, so that their utilization of the provisions of the Act for direct loans has the same practical effect as the establishment of associations among their suppliers.

DISTRICT BOARDS.

The majority of the applications for loans of £250 or under submitted either through associations or direct to the Board are dealt with and granted or declined by the district boards The district boards also consider all direct applications in excess of that sum, and submit recommendations regarding them for the guidance of the central Board. The tendency is to gradually increase the powers of the district boards.

In addition a number of matters affecting the administration of direct loan accounts, such as applications by borrowers for readvances for necessary purposes of sums received from the realization of stock and produce or from other sources, are dealt with by committees of the district boards composed of the District Supervisor and at least one other member of the district board

LOANS TO FARMERS' CO-OPERATIVE ORGANIZATIONS.

Advances are also made to farmers' co-operative societies upon the security of live-stock or produce. To be eligible to receive a loan a co-operative society must be engaged in the production or sale of staple agricultural or pastoral products, including live-stock and goods manufactured from any such produce, must have a subscribed capital of not less than £2,500, and be composed of not fewer than thirty members.

DISCOUNTING.

The central Board is also authorized to discount farmers' promissory notes or bills of exchange which are endorsed to the satisfaction of the Board. The maximum amount available to a farmer by this method is £200, and the amount of any other loans which he may have obtained from the Board has to be taken into account to ensure that the total accommodation provided for him does not exceed the limit of £2,000 fixed by law. The discount rate is 6½ per cent., and the period for which advances are made in this method is restricted to one year, or in special cases two years.

The discounting method is utilized mainly by dairy companies desirous of assisting suppliers to finance their minor seasonal farm requirements, such as manure and seeds, and small purchases of stock. The dairy companies usually arrange for a deduction from the milk or cream cheques of suppliers for whom they have discounted notes, in order that they may be in possession of sufficient funds to meet the notes on maturity. Where a dairy company is discounting a large number of notes with the Board the monthly deductions reach a considerable total, and in such cases the Board permits the company to retire promissory notes prior to maturity and allows a rebate of interest, but insists that this saving of interest must be passed on to all the suppliers affected. In these circumstances borrowers will be paying 6½ per cent. only on the amount outstanding on account of their loans from month to month.

Up to the present thirty-seven companies have made arrangements with the Board to accept their endorsements of promissory notes for discounting with the Board. The method of fixing limits for companies is identical with the procedure in connection with the limits imposed in respect of guaranteed loans.

SHEEP AND GRAIN SECURITIES.

Up to the present the scheme has been utilized mainly by the dairying industry, the loans granted to other classes of farmers such as sheep-farmers and grain-growers being limited in number and amount. This is due to a number of special causes. In the first place, the limit of £1,000 fixed by the principal Act proved insufficient for the requirements of sheep-farmers and grain-growers during the period when no revenue is forthcoming and the expenses associated with farming operations have to be met. In the second place, sheep-farmers did not have at their disposal the same facilities for obtaining guarantees of loans as dairy-farmers with their dairy companies behind them, and consequently were not able to utilize the provisions of Part III of the Act to the same extent. In the third place, the system for fixed loans to be liquidated over a period of years, although suited to the requirements of dairy-farmers, was not applicable to the circumstances of sheep-farmers, whose indebtedness steadily increases during the major portion of the year and is then rapidly liquidated either in whole or in part.

In view of the fact that sheep-farmers may be expected to approach the Board mainly through the medium of associations, the introduction of this system is expected to stimulate the formation of associations in sheep-farming districts.

General.

Each country has its own peculiar financial and seasonal difficulties, but the problem in each is how to discount farm securities at the lowest possible rate. It is generally agreed that the solution is not to be found in the duplication of existing institutions, but in organizing the resources of the primary producers themselves, so as to provide a basis for joint concerted action in their own behalf in order to get the capital they must use.

"The development of the group system gives the farmer the experience which teaches him to use money in a business way, leading ultimately to financial independence, by putting him in direct relationship with a self-supporting institution through which capital can be obtained. In combination farmers can command capital, credit, technical advice, and commercial attention. The fact that the resources and responsibility of several individuals are combined together increases the confidence of lenders and creates an asset which is equivalent to the asset of goodwill upon which corporate industry relies."

This possibility exists in New Zealand, where the co-operative spirit is well developed. The State and State-fostered schemes are established on a sound basis with adequate provision for administration and losses. They have brought the borrowing farmers into closer relationship with the lenders, and money is borrowed and loaned at cost price, but that price is governed by inexorable laws, and can only be reduced by the

willingness of farmers themselves to undertake certain services and responsibilities, which they can do with little or no financial risk when properly organized. In New Zealand they have the opportunity and are taking advantage of it.

NOTE.—In regard to the foregoing paper the writer acknowledges his indebtedness to various reports and publications, which have been freely drawn upon to set out the position in New Zealand.

FEEDING OF IODINE TO POULTRY.

SOME LOCAL EXPERIMENTS AND RESULTS.

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IT has been shown experimentally that the addition of iodine to the food or drinking-water of fowls will add at least one year to the productive life of each hen. Not only so, but it has been reported from British Columbia that in certain cases hen-eggs, though fertilized, failed to hatch out; when iodine was introduced into the diet the trouble was removed. The administration of iodine to laying hens also results in an increased iodine content of the eggs, making iodized eggs a valuable food item for those who cannot take iodine in the usual way.

The experiments recorded in the following matter were carried out in the Hutt Valley, near Wellington. Some White Leghorn fowls, about four or five years old, were fed potassium iodide in increasing doses in the drinking-water through the spring and summer of 1929–30. In their second and third years these birds had been good layers. Before starting iodine feeding they were moulting and not laying at all, but after iodine feeding was commenced they laid more eggs than was expected of hens of that age. They also appeared to be healthier, moulted completely, and quickly regrew their feathers. Eggs were collected from these hens, incubated, and hatched out. All the eggs were fertile, and 85 per cent. were pullets.

There were nine hens. The potassium iodide was weighed out for them and put in the drinking-water trough. The dose was 2 milligrams of potassium iodide per hen per day, but of course they did not all drink the same amount of water. The hens had this dose for three weeks from 1st June. The dose was then doubled, and the hens received 4 milligrams of potassium iodide each per day up to 21st August, 1929.

The results are shown in the following table. In each case the eggs were weighed without the shells.

Table 1.

Date.	Weight of Egg.	Iodine in Egg	Iodine in 100 Grammes.
	Grammes.	Gammas.*	Gammas *
3/7/29	50·4	568	1,127
28/7/29	52·6	212	404
21/8/29	52·2	213	407

* Gamma = one-millionth of a gramme.

Normal (non-iodized) eggs from the same place gave the following iodine content :—

Table 2.

Date.	Weight of Egg.	Iodine in Egg.	Iodine in 100 Grammes.
	Grammes.	Gammas.	Gammas.
1/7/29	45·4	6	14
29/7/29	53·[illegible]	8	14
23/8/29	48·9	13	26

Iodine feeding was continued from 21/8/29 to 9/10/29, each fowl getting 8 milligrams of potassium iodide in the drinking-water per day, with the following result :—

Date.	Weight of Egg.	Iodine in Egg.	Iodine in 100 Grammes.
	Grammes.	Gammas	Gammas
9/10/29	56·6	425	754

A normal egg for comparison gave—

Date	Weight of Egg	Iodine in Egg	Iodine in 100 Grammes
	Grammes	Gammas	Gammas.
12/10/29	52·2	14	26

The iodine was now stopped and no iodine fed for a fortnight previous to 3/11/29. The result is shown in the following analysis :—

Date.	Weight of Egg.	Iodine in Egg.	Iodine in 100 Grammes
	Grammes.	Gammas	Gammas
5/11/29	53·0	43	80

From 3/11/29 to 18/12/29 the hens were getting approximately 16 milligrams of potassium iodide each per day, from 18/12/29 to 22/2/30 64 milligrams, and from 22/2/30 to 29/3/30 128 milligrams.

The hens were killed in the beginning of April. For a few days previous they were getting 256 milligrams of the iodide per day, this being approximately 3 grains of iodine. Three grains is the dose quoted as being the optimum. One egg was found in the oviduct of one of the hens after it was killed. Table 3 (opposite page) gives the further results.

Hercus and Roberts (*Journal of Hygiene*, Vol. 16, No. 1, 30th March, 1927) by a similar experiment increased the iodine content of eggs from 4 gammas to 880 gammas per 100 grammes in a fortnight. Three weeks after the discontinuance of the treatment the iodine content dropped to 14 gammas per 100 grammes.

Table 3.

Date.	Weight of Egg.	Iodine in Egg.	Iodine in 100 Grammes.	Dose of Potassium Iodide per Hen per Day.
	Grammes	Gammas	Gammas	
18/12/29	54·0	520	964	16 milligrams.
22/2/30	51·4	1,105	2,150	64 milligrams
22/2/30	49·3	10	19	*
26/3/30	55·3	807	1,461	128 milligrams.
29/3/30	42·6	1,057	2,483	128 milligrams.
29/3/30	58·1	956	1,645	128 milligrams
23/3/30	44·7	12	26	*
27/3/30	44·9	16	36	*
2/4/30	37·9	2,231	5,887	256 milligrams (egg from oviduct).

* Normal egg—no potassium iodide fed.

The iodized hens were killed and weighed. The thyroid glands were dissected out and weighed, and the iodine content estimated. Two normal hens were treated similarly. Two pullets six months old hatched from iodized eggs were also killed, weighed, and the thyroids dissected out and the iodine content estimated. Two normal pullets were treated similarly. Table 4 sets out the results.

Table 4.

Date	Description.	Weight of Hen.	Age of Hen	Weight of Thyroid.	Iodine in Thyroid.	Percentage of Iodine.
		lb. oz.		Grammes.	Grammes.	
2/4/30	Iodized hen laying ..	4 1	3 years	0·1380	0·007	0·505
2/4/30	Iodized hen just stopped laying ..	3 10	4 years	0·2655	0·0011	0·426
2/4/30	Iodized hen not laying	3 14½	5 years	0·2049	0·0004	0·212
2/4/30	Iodized hen not laying	4 10	5 years	0·2571	0·0004	0·147
2/4/30	Non-iodized hen ..	2 14	3 years	0·1766	0·0004	0·217
7/5/30	Non-iodized hen ..	3 11	3 years	0·2408	0·0004	0·154
2/4/30	Pullet from iodized egg	3 2	6 months	0·1140	0·0001	0·097
2/4/30	Pullet from iodized egg	2 12	6 months	0·0830	0·00006	0·067
2/4/30	Pullet from non-iodized egg	2 0	6 months	0·1197	0·0002	0·178
14/5/30	Pullet from non-iodized egg	2 15	6 months	0·1297	0·0002	0·138

Fowl thyroids in the United States have been shown to have an iodine content of from 0·105 to 0·38 per cent., and in Scotland from 0·14 to 0·21 per cent.

Quoting from the literature on this subject, the iodine content of eggs varies in Switzerland from 8 to 22 gammas per 100 grammes, in Germany from 5 to 33 gammas, in Scotland from 5 to 20 gammas, and in New Zealand from 6 to 14 gammas (Hercus and Roberts). Hercus and Roberts also found a distinct seasonal variation in the iodine content of eggs, the maximum being in the summer. Some eggs from Tai Tapu, Canterbury, gave on analysis the figures for iodine set out in Table 5 (next page). It will be noticed that the lowest iodine content occurs in April and May.

Table 5

Date	Weight of Egg	Iodine in Egg.	Iodine in 100 Grammes
	Grammes.	Gammas	Gammas
21/9/29	43·8	9	19
24/10/29	53·0	7	14
11/12/29	42·7	8	19
31/1/30	47·8	7	14
24/2/30	53·2	10	18
24/2/30	48·5	9	19
3/4/30	65·4	5	8
3/5/30	56·1	5	10
21/9/29*	47·6	7	14
21/9/29*	42·2	10	25

* Christchurch eggs

GENERAL REMARKS.

The peculiar point which emerges from the locally conducted iodine-feeding experiments is that the iodizing of the eggs did not have much effect on the iodine content of the thyroids of the pullets hatched from these eggs. They were the smallest thyroids and had the lowest iodine content of all. As previously mentioned, all the eggs from the iodized hens were fertile, and 85 per cent. were pullets.

These experiments confirm the fact that the iodine content of eggs may be increased by a very simple and cheap means, and this affords another method of feeding iodine to the human consumer—a method which may have distinct advantages over others.

CELLOPHANE PAPER AND WOOD-TAINT IN BUTTER.

AN experiment was recently carried out at the Moturoa Grading Stores to ascertain whether Cellophane paper as a liner for Swedish timber butter-boxes could prevent contamination of the butter with the aroma of the wood. By courtesy of the Inglewood Co-operative Dairy Co., which use Swedish butter-boxes, four of the boxes were packed with butter from the same churning. Two boxes were lined with a wrapping consisting of Cellophane envelope and a wrapping of parchment-paper, and the other two boxes with the usual two wrappings of parchment-paper.

The butters were regraded after two months' cold storage, and all found to be wood-tainted on the surface. Had this defect not been present the quality of the butters would have stood up to the original grade score of 95 points. The butters were afterwards held for about a week at ordinary temperatures in the grading-room, and both the specially wrapped and control butters were surface-tainted to much the same extent.

It is therefore concluded that the use of Cellophane paper is of no practical value for the purpose indicated.

—*Dairy Division.*

PROSPECTING FOR PHOSPHATE ROCK.

PROCEDURE UNDER THE MINING ACT.

Mines Department.

THE statutory procedure to be followed to obtain a right to prospect for phosphate rock under the provisions of the Mining Act, 1926, depends to a large extent upon the date and nature of the title to or the ownership of the land upon or under which it is desired to prospect. The existing law governing such procedure is somewhat involved, and it is therefore prudent for a prospector to engage the services of a solicitor in all cases where he is satisfied that the mineral prospects are such as would justify the incurring of the legal expense necessary to obtain the grant of a mining privilege. However, as it is desired to place prospectors in a position to understand the matter (though without accepting any responsibility as to the effect) the following brief summary of the law is given :—

(1) The Crown has no jurisdiction over phosphate rock, or any other mineral, unless it is situated on Crown land, or on lands the mineral rights of which are reserved to the Crown

(2) If the mineral is situated on private land, and the owner holds the mineral rights, no prospecting for or any action in connection therewith can be commenced without the consent of the owner and occupier.

(3) The first essential necessary to engage in prospecting operations is a miner's right, which will, upon application, be issued by any Warden or Mining Registrar, or by any duly authorized Postmaster. The fee payable is 5s. where the application does not relate to Native ceded land, but where it does so relate a fee of £1 is payable. The right continues in force for twelve months and is not transferable.

(4) A miner's right confers upon the holder the right (*a*) to prospect for any metal or mineral on Crown lands open for prospecting, excepting Native ceded land; or all such lands with the addition of any such one block of Native ceded land as is specified in the miner's right at the time of its issue; (*b*) to take up and hold *within a mining district*, without application to or license from the Warden, one ordinary alluvial claim for each miner's right. The area of an alluvial claim held under this condition is 10,000 square feet.

Under the definition in the Mining Act, 1926, "Crown lands" means all lands whatsoever the title whereto in fee-simple is vested in His Majesty, whether by virtue of his prerogative or by operation of law, or by any deed or instrument, whether such lands are unalienated or are alienated by way of lease or license for depasturing purposes, or as a small grazing-run, under any Act providing for the disposition of lands of the Crown; and includes Native ceded lands, and all other lands whatsoever over which His Majesty, or the Governor-General or the Minister on his behalf, by cession, agreement, or otherwise, possesses the right to authorize the carrying-on of mining operations; but except where otherwise specially provided in the Mining Act, 1926, does not include (*a*) lands held by His Majesty on any trust, express or implied, in favour of any person; nor (*b*) lands held by His Majesty but dedicated to any public purpose; nor (*c*) public reserves and endowments within the meaning of the Mining Act, 1926.

Lands open for prospecting include Native land which a Native Land Court has, upon application by or on behalf of the Governor-General, declared to be open for prospecting in terms of section 30 of the Mining Act, 1926.

All public reserves and all endowments, as previously stated, also Native reserves, are, with the following exception, exempt from the operation of the Mining Act, 1926: Provided that all such reserves and endowments and Native reserves which, on the coming into operation of that Act, were within the operation of any former Mining Act are to the same extent subject to the operation of the first-mentioned Act. The exception referred to relates to lands set apart for forest purposes or for scenic purposes, in both of which cases no rights can be issued without the consent of the Minister for the time being charged with the administration of the State Forests and Scenery-preservation Acts.

5) As stated in paragraph (2), the Crown has no jurisdiction over private lands the owner of which holds the mineral rights. If the owner of the freehold is also the owner of the minerals the procedure to be followed is to obtain the consent of the owner and occupier (if any), and then apply to the nearest Warden's Court for any description of mining privilege authorized by the Mining Act in the case of Crown lands in a mining district.

(**6**) If it is desired to obtain a prospecting warrant or a prospecting license, the Governor-General, in respect of Native land, or the Warden in the case of other lands that are open for prospecting and which are situated in a mining district, may, in pursuance of section 70 of the Mining Act, 1926, grant such warrant or license respectively, subject to the applicant complying with the requirements of section 73, and also subject to the written consent of the owner and occupier of the land described in the foregoing paragraph (5). Attention is also called to Regulations 7 to 14, both inclusive, under the Mining Act, 1926, relating to such rights.

In the case of lands open for prospecting situated outside a mining district, other than Native lands, the Commissioner of Crown Lands may, subject to the consent of the Minister of Mines, and subject to the conditions already referred to, grant such warrant or license.

(**7**) The term of a prospecting warrant or prospecting license is one year. The holder has, however, the right in priority in respect of the land included in such warrant or license, provided (1) he gives notice in writing, not less than fourteen days before the expiry of his warrant or license, of his intention to apply for a new warrant or license, (2) the application is made not later than seven days after the expiry of the warrant or license, and the land comprised therein has within that period been identified or marked out as required in an application under paragraphs (*b*) or (*c*) of section 73; and (3) the applicant furnishes with his application full particulars in writing of the work done and money expended by him in prospecting operations during the preceding twelve months, and the Governor-General or Warden, as the case may be, is satisfied that the applicant has satisfactorily carried out the terms and conditions of the expired warrant or license. A fee of £1 is payable in repsect of a prospecting warrant, and a fee computed at the rate of 1s. for every acre of land, but being in no case less than £1, in respect of a prospecting license, both fees being payable in advance. The area is limited to 100 acres, but any number of warrants or licenses may be acquired by one person.

A prospecting warrant confers a non-exclusive right, and a prospecting license an exclusive right, to prospect on the land to which it relates.

The conditions to which the issue of prospecting warrants or licenses are subject, the provisions which apply in respect of the payment of compensation to the owner and occupier of land not being unalienated Crown land for damage done to such land, and a schedule of lands which are exempted from prospecting are contained in sections 74 to 76 of the Mining Act, 1926.

(**8**) With the consent in writing of the Minister of Mines, the Warden within a mining district, or the Commissioner of Crown Lands outside a mining district, may, pursuant to section 77 of the Mining Act, 1926, grant

to any person a mineral prospecting warrant authorizing the holder to prospect for any specified mineral or minerals over any Crown or other lands specified in the warrant, not exceeding 10,000 acres; provided that no such warrant will be issued with respect to any land other than Crown land unless the consent in writing of the owner and lessee (if any) of the land has been obtained and is deposited with the Warden or the Commissioner, as the case may be

The term of such warrant is five years, and the holder has the exclusive right to prospect for the mineral or minerals specified in the warrant on the land to which the warrant relates A deposit as security for compliance with the requirements of the Mining Act and regulations is required to be made by each applicant for a warrant, such deposit being £50 for the first 1,000 acres applied for, with an additional £25 for each 1,000 acres or fraction thereof in excess of 1,000 acres The rental payable is 1d. an acre per annum for the first two years, 2d. for the third year, 3d. for the fourth year, and 6d. for the fifth year.

The provisions of the law relating to the labour to be employed on the area comprised by the warrant, the necessity to transmit six-monthly reports of prospecting and statements of expenditure, and the conditions governing the refund of the deposit, are contained in Regulations Nos. 18, 19, and 21 under the Mining Act, 1926.

(9) At any time while a mineral prospecting warrant is in force the holder, if he is satisfied that the mineral for which he is prospecting exists in payable quantities, has the right under section 81 of the Mining Act, 1926, to a mineral lease of such part of the land to which the warrant relates, not exceeding 1,000 acres and in one continuous block, as he may select. The term of a mineral lease is not to exceed sixty-three years.

A deposit, as security for compliance with the requirements of the Mining Act and regulations, must accompany each application, such deposit being at the rate of £1 for every acre of land applied for, but not exceeding in the whole a deposit of £1,000. A rental of 2s. 6d. an acre or part thereof per annum is payable under a mineral lease, and a royalty of one-twentieth of the value of the mineral at the pit's mouth, such value to be fixed before a lease is issued. Should the prescribed royalty exceed the amount of rent in any one year, then such rental ceases for that year. The regulations relating to mineral leases are Nos. 16 to 17 and 20 to 23.

(10) With the consent of the Minister of Mines the Warden may, pursuant to section 106 of the Mining Act, 1926, and subject to the provisions of that Act, grant mineral licenses authorizing the licensees to occupy any Crown land within or outside a mining district for the purpose of mining for any specified metal or mineral other than gold. The maximum area that may be held under a mineral license is 320 acres, and the term of the license may be for any number of years up to forty-two.

Rental is payable at the rate of 2s. 6d. an acre or part thereof, and in addition a royalty in respect of all the specified metals and minerals raised pursuant to the license, such royalty being not less than one-hundredth nor more than one twenty-fifth of their value at the pit's mouth.

Attention is directed to section 169 of the Mining Act, 1926, and Regulation 33 thereunder, in which is set forth the general procedure on applications to the Warden or Commissioner of Crown Lands in respect of mining privileges. Where a mining privilege is required by law to be marked out or surveyed attention is also called to Regulation 32 and Regulations 34 to 37, both inclusive.

Prospectors are recommended to acquaint themselves with the provisions of the Mining Act and the regulations relating to the acquisition of mining privileges. Copies of the Mining Act, 1926, and the regulations thereunder may be obtained from the Government Printer, Wellington, at 10s., plus 1s. for postage and registration.

TREE-PLANTING METHODS.

PRACTICAL GUIDANCE FOR SETTLERS.

Extract from State Forest Service Circular No. 19, "Tree-planting."

As methods of planting trees are governed by the class of soil, climatic conditions, magnitude of area, and the species and type of stock utilized, it is not possible to lay down a definite rule to be followed in all cases. It is hoped, however, that the description of the various methods adopted by the State Forest Service will prove of assistance to private planters and enable them to evolve a practice to meet individual requirements.

A settler who plants a few acres annually is usually able to devote more time and care towards preparatory cultivation, &c., than is possible in large-scale operations of commercial projects where economy of establishment has an important bearing on the ultimate financial success of the plantation, and consequently more satisfactory results should be attained from farm plantations.

PREPARATION OF THE LAND.

The extent to which the land should be cleared prior to planting depends largely upon local climatic conditions and the existing weed-growth. In many localities it will be found desirable to leave the low-growing indigenous growth in order to afford protection to the young trees. In districts subject to unseasonable frosts its has been found preferable to burn off all growth which is likely to impede the free circulation of the air.

Generally it will be found advisable to remove in some measure the strong growth, such as manuka or very heavy bracken, if it tends to impede the work of planting or to shade excessively the young trees in their earlier years. Burning-off should be carried out some time previous to planting, which should be deferred until the land has been well soaked with rain.

Scrub or slash should be burnt off before commencing planting operations, as dead and dying timber is unsightly, in falling it tends to injure the young growth, increases the danger from fire, and invites and harbours many species of insects which may be injurious to young growth.

For small areas and wind-breaks where quick growth is specially desired it will be best to plough and cultivate the area to be planted; if the soil is very poor, a little manure, such as basic super, can be worked in during cultivation. Remarkably quick growths are often obtained under such favourable conditions, and the ploughed area can often be utilized during the first season for the growth of such crops as potatoes, &c., between the lines of trees.

PLANTING-DISTANCES.

Several factors govern the proper distances at which to space trees, individual requirements being to some extent the determining one. For example, single rows along fence-lines may be spaced in accordance with the planter's desire and object. In order to provide close

shelter a spacing-distance of from 12 ft. to 16 ft. will generally be found suitable. Intervals of 6 ft. to 8 ft. will more rapidly attain that objective, but the trees will not retain so many lower branches, although the ultimate timber produced will be of better quality. In practice, probably the most satisfactory method is to plant at 6 ft. to 8 ft., to achieve quick shelter; and then to remove every alternate tree whilst still in the sapling stage.

If the objective is the growth of merchantable timber the trees should be spaced 8 ft. apart each way, which is considered more economical and suitable for most conifers and eucalypts, and is adopted as the standard for the State plantations.

Owing to its strong branching habit, *Cupressus macrocarpa* when planted with the object of providing fencing-material and timber should, however, not be spaced more than 6 ft. apart each way.

The following table indicates the required number of trees at specified distances apart:—

Number of Trees required to plant an Acre of Ground, and also for Lines One Mile in Length.

Distance apart, in Feet.	Number required		Distance Apart, in Feet.	Number required	
	Per Acre	Per Mile Length.		Per Acre	Per Mile Length.
3	4,840	1,760	17	150	310
4	2,722	1,320	18	134	293
5	1,742	1,056	19	120	278
6	1,210	880	20	110	264
7	889	754	21	99	251
8	680	660	22	90	240
9	537	586	23	83	230
10	435	528	24	75	220
11	360	480	25	70	211
12	302	440	26	64	203
13	257	406	27	61	195
14	222	377	28	55	188
15	193	352	29	51	182
16	169	330	30	48	176

TIME TO PLANT.

Generally speaking, in the North Island planting carried out before the end of May gives the best results, but for spring planting mid-August to the end of September is usually suitable.

In the South Island August and September are usually preferable, but in the northern portions of Canterbury and farther north some autumn planting can be done in May.

This applies in a general way to small-scale planting for farmers, local bodies, &c., and is intended to give optimum results only. On large-scale planting in many districts advantage may be taken of the whole late May – early October season for planting purposes. In some few districts early and dry spring weather makes autumn planting compulsory; in others a rigorous June and July enforces September planting to the exclusion of all other months. The choice of planting time in such exacting districts can only be made by close knowledge of local conditions.

PLANTING METHODS.

(1) *Pitting*.—This method consists of the formation of holes or pits. In open pits the soil is taken out with the fourth cut of the spade and deposited alongside the hole, broken up, and replaced when planting the trees.

A modification of this system has been practised to a great extent in the State plantations, whereby the soil is turned over into the hole and chopped with spade. When planting takes place the spade is driven vertically into the loosened soil and the tree planted firmly in the slit. This is an excellent method when planting small areas and shelter-belts, and is eminently suitable for trees with a large root-system, or for species of a tender nature, such as macrocarpa.

(2) *Notching*.—Notching aims at cutting out the cost of pitting by planting the trees on land without any previous preparation except clearing. Where a heavy grass turf exists notch planting is not advisable without first cutting away the turf, as unless great care is exercised grass is pushed into the cut by the spade, which in dry weather tends to open the ground, admitting sun and wind to the roots of the tree. Under such conditions, pitting, grubber planting, or line ploughing should be adopted. Several methods of notching are practised, the crudest being that of simply inserting a spade into the soil and moving it backwards and forwards to make an opening, in which the tree is inserted. The weakness of this method is that the backward and forward movements of the spade make an opening the shape of an hour-glass, which it is not possible to eliminate, and tend to cause heavy losses through air-space at the bottom of the cut.

The difficulty may be eliminated by one of the following methods :—

(*a*) Make two spade-cuts in the soil, the second cut being at right angles to the first and joined at one end, thus forming two adjacent sides of a square in the form of the letter L. When making the second cut the handle is drawn backwards before the spade is removed, thus lifting up the soil in a roughly triangular piece, and leaving an opening in the angle formed by the two cuts, in which the tree is inserted. After the tree is placed in position the spade is withdrawn, and the tree firmed by tramping the sod hard back into position.

(*b*) Upright T : This method is successful in loose or crumbling soils. The tail of the T is made with the first cut and the top with the second. The back of the spade faces away from the planter, and is pressed slightly back to make a firm face on the top of the T. The handle of the spade is then drawn towards the planter, and the tree is placed in the opening thus left at the back of the spade, which is held in the ground meanwhile to prevent the loose soil filling the cut. When the tree is in position the spade is removed and the soil pressed back with the foot.

(*c*) Reclining T : *i.e.*, the first cut is across the line to be planted, and the second cut is made anywhere across the first, really forming a T on its side thus, ⊣ . The handle of the spade is drawn across the front of the body, the action levering up the two sides of the stem of the T. The tree is placed in the centre of the opening with a downward and then upward sweep. The downward sweep puts the roots well down and the upward pull brings the tree in the right

position with the roots standing open and upright. When the spade is taken away the two sides fall, and, meeting on the stem of the tree, form a very effective jam, which is secured by two stamps of the heel, one on either side of the cut. This method is satisfactory in firm or stiff soils. If tried in loose soil the first cut does not open up cleanly. The method has the advantage of the spade-handle being out of the planter's way when the tree is being planted

(*d*) In this method the first cut of the spade is made diagonally, the second cut vertically. After inserting the spade to its full depth (9 in.) the second time, the planter pushes the handle away from him, with the result that a wedge-shaped block of soil is pushed outwards. The tree is inserted against the vertical face. and the soil pushed back against it with the heel of the boot. . This method is satisfactory on medium clay land and medium stony country with the aid of a triangular-shaped steel planting spade or spear.

A careful perusal of these descriptions will show—(i) That in each case the objective is to provide a vertical face against which the tree can be planted: (ii) that the opening must be made in such a way that *a proper firming of the soil is ensured and no air-spaces are left.*

Where the wind is a serious factor, the upright face of the opening should face to the prevailing wind.

(3) *Grubber Planting.*—On steep country and heavy grass-land grubber planting has proved to be entirely satisfactory, and almost as cheap as notching. The best tool for the purpose is a No. 2 shipwright's or carpenter's adze, with a blade about 9 in. long. The grass or weeds should first be chipped off the planting-spot and the blade driven into the soil to full depth; next, with an upward movement wrench the soil up, withdraw the adze and drive in again in the same place as straight as possible, then pull the adze forward, and a planting-hole is thereby made about 9 in. deep. Place the tree in this opening, work in the soil with the adze, and *tramp firm.*

(4) *Line Ploughing.*—A planting-line is formed by means of a single-furrow plough. One light furrow is turned over, and the trees notched in with a spade or planting-tool in the bottom of the furrow. The method is simple, and is suitable on *flat* grassy country. The trees are sheltered, free of interference by grass-growth, but in order to retain the top soil the furrow turned over should be light.

PLANTING FROM TRAYS.

For such species as macrocarpa and some of the eucalypts, trayed or boxed trees are recommended in preference to open-rooted stock, which is difficult to transplant successfully.

Planting should be done in the following manner: The planting-pits should first be prepared, and the ends of the trays cut down with a tin-opener. At the actual time of planting, each tree, with about 1½ in. of soil and matted root attached, should be moved separately by cutting with a sheath-knife.

By following this plan of raising and handling the seedlings, with a little care the loss should not exceed 1 per cent., whereas if the open-rooted method is followed a large percentage of the young trees may not survive the first season.

Unpacking and Treatment of Trees not immediately required.

Trees are usually packed to arrive in good condition after a week or ten days' journey, but in cases where extraordinary delays occur and the plants arrive in bad order they should be treated as follows to harden them gradually to open-air conditions :—

Take the plants from the case and stand them upright in a shallow box. Open up the bundles to allow the air to circulate freely around the stem and leaves of each plant, and cover the roots with damp moss, straw, and soil. Leave them for about twenty-four hours in the shelter of a cool shed and away from direct sunlight. The trees should then be heeled-in or lined-out for a week or two, and for this purpose a well-worked, somewhat dry piece of ground should be selected, and on no account use damp, cold land. Space the plants in rows 1 ft. apart and from ½ in. to 1 in. between each plant. It is most important to tramp the soil firmly over the roots of such heeled-in plants. Loose soil holds air pockets which allow roots to dry out. Plants treated in this manner are much more likely to succeed than if taken direct from the packing-case and placed in their permanent positions.

It must be understood that this procedure is only necessary when plants are in bad condition on arrival. Slightly withered and droopy trees can generally be revived by *opening up bundles* and placing plants in a shady position, with roots buried in moist soil, for a few days.

Where trees are not required for immediate planting the bundles should be opened up and the seedlings heeled into a trench about 1 in. or so apart (more if the trees are large and bushy) and their roots covered with soil, fairly well firmed. (This heeling-in ground should not be in a wet and cold place) By this method trees can be held for any reasonable length of time.

Plants supplied in trays, when not required for immediate planting, may be sunk flat into soil in a sheltered place, and if watering is necessary it should be done sparingly.

Summary.

The advantages and disadvantages of various methods may be thus summarized :—

Pitting :—

(1) An inexperienced or careless planter is less likely to get the roots into the ground straight. Open pits are especially good in heavy clay land, and are essential in excessively stony soil.

(2) An open pit or the prepared spot induces a quicker start being made by the tree.

(3) Rows of trees are more easily distinguished if blanks have to be replaced.

Notching :—

(4) Notching reduces the cost per acre by from 15s. to £1.

(5) Trees planted by notching may not grow as rapidly for the first year as in prepared soil.

(6) There is no appreciable difference in the death-rate of trees planted by the different methods.

(7) The effects of heavy frosts are less than where the ground is disturbed more, as in pitting.

Whichever method is adopted the human factor is always present. There is a right and a wrong way to plant a tree, and to get results the planter must be sufficiently interested in his work to be determined upon success.

The following general rules should be observed in order to obtain success:—

(1) Plant the tree no deeper than it was growing when in the nursery.

(2) Place the tree in the centre of the pit, so as to allow the roots an even chance all round. In very exposed places the plant should be placed against the solid earth on the side of the pit facing the prevailing wind.

(3) Plant the tree in an upright position, with tap-root going straight down and lateral roots spread out and not bunched together or bent.

(4) Never allow the roots to become dry, or even apparently dry.

(5) Work the soil first gently in about the roots, *then firm it well by tramping the surface.*

(6) Care must be exercised to avoid damaging or barking the stem when firming the soil round the planted tree.

CASTRATION OF PIGS AND CALVES.

PRECAUTIONS AGAINST SCROTAL ABSCESSES.

J. E. McIlwaine, M.R.C.V.S., Animal Husbandry Section, Live-stock Division.

A somewhat prevalent defect in dressed pig carcasses, as noticed at the various works, is the presence of abscesses in the scrotal region at the seat of castration, apparently the result of infection gaining entrance at the time of the operation. If the general grading of pork is introduced, as called for by the recent conference at Palmerston North, such abscesses may debar carcasses from export. The extra dissection required to remove the abscesses is liable to injure the hind quarters, especially involving the valuable cuts.

It is usual to carry out the operation of castration when the young pigs are about three or four weeks old. Occasionally it may be necessary to castrate an older animal, but farmers would be well advised to make it a practice of castrating at an early age. The actual requirements for the operation need not necessarily comprise any elaborate outfit, but emphasis must be laid on the necessity for cleanliness. Thorough cleanliness of the hands, the operating-knives, and the quarters occupied by the pigs both before and after the operation is essential to prevent sepsis and abscess formation. Cleanliness as applied to the operating-knife means sterilizing by boiling for a few minutes. The blade may be wrapped in cotton-wool during boiling. Cleanliness in the quarters means a clean bed of fresh straw, or if the pigs are in the open a fresh green paddock with a good sole of grass. The hands should be scrubbed and attention paid to the finger-nails, as the nails often come in actual contact with the wound during the removal of the testicle.

The following is a procedure which should give good results, provided the foregoing precautions are taken. The knife is already prepared, and it is also desirable to have a bucket containing a weak solution of a reliable antiseptic at hand. When not in use the knife should be returned to the bucket of antiseptic and left there till again required. An assistant seizes the pig by one of the hind legs and carries it to the operator. It is usual to fix the pig with the nose under one arm (squealing may be thus controlled), and the assistant, holding a hind leg in each hand and seated, exposes the site of operation. The operator paints the site with tincture of iodine, or, if much dirt is present, swabs the site with an antiseptic solution contained in a separate vessel from that holding the knife. One testicle is isolated between the fingers and thumb of the left hand, the skin is firmly held over the testicle, and an incision made from one end to the other, when the testicle is exposed. With such young animals it is usual to scrape the cord for detaching the testicle. The risk of hæmorrhage is very slight. The same procedure is adopted with the other testicle, and before the animal is released in its clean surroundings the wounds are flushed by pouring some antiseptic into them. This is obtained from the vessel used to contain the knife The knife may be returned to this vessel until another pig is procured for the operation. Probably a common cause of abscess-formation is the fact that the incision in many cases is too small, and does not allow proper drainage at the lowest point afterwards. Thorough cleanliness should be observed by the operator throughout.

The Burdizzo instrument is not suitable for the castration of pigs, the scrotum being too closely attached to the body.

In the case of calves castration is usually carried out at the age of from two to three months. An assistant is required to control the calf, whether the animal is cast or whether the operation is carried out with the calf in the standing position. It is not necessary to use any special means of control, provided the calf is firmly held against a fence or something equivalent. The procedure is similar to that described for pigs, and scraping the cord is the usual method of detaching the testicle. The cord may be severed by an emasculator, but this instrument is not necessary for such young animals. It is advisable, however, to use it when older calves or pigs are being operated upon The method in which two incisions are made, instead of removing the end of the scrotal sac, aims at leaving a better "cod," as expressed in butchers' terms.

In conclusion, it is advisable for a beginner contemplating the performance of this operation to obtain a demonstration from an experienced operator. The time required to operate with care and cleanliness does not exceed that required by careless work, and the results are much more satisfactory. The correct method is worth acquiring from the first, and details must be attended to if an all-round improvement on the lines indicated is to be attained.

"Ante-natal Deformity of Lambs": Correction.—Referring to the paragraph on iodine deficiency in this article as published in last month's *Journal* (page 296), the analyses of thyroids were inadvertently stated as both made from fœtuses. Analysis No. 2 was from the thyroid of a ewe which produced a deformed fœtus.

SEASONAL NOTES.

THE FARM.

The Pastures.

EXTENSIVE experience has taught that pasture top-dressing may be carried out with good results during July where it has not been done earlier If from such top-dressing it is desirable, as it usually is, to secure growth as quickly as possible, then ordinarily superphosphate should be used. Even on relatively cold soils super applied in July has been found to produce substantial increases in the amount of feed available in August. It is not to be inferred from this that July is the month which should be selected for the application of super; previously in these notes the application of super and of other phosphates to grassland much earlier in the season has been recommended. Now the matter is mentioned again because if the top-dressing for some reason or other has not yet been done it may still be carried out with profitable results.

Under normal conditions the application of sulphate of ammonia about mid-July to suitable grass-paddocks may be counted upon to result in a material increase in the feed available from the dressed paddocks during August and September. For a few weeks prior to the middle of July it is probably well not to apply sulphate of ammonia; it appears not to act at this period when plants tend to be most dormant in their growth, and its fertilizing influence is apt to be more or less wasted. Fields to which sulphate of ammonia is to be applied should be grazed down evenly and closely, and thoroughly harrowed prior to the application As a general rule super should be used in conjunction with sulphate of ammonia. As an emergency means of increasing the early-season grass-growth when there is a prospect of scant supplies of feed the use of sulphate of ammonia on grassland promises to be successful, especially if the pasture to which it is applied contains a considerable proportion of rye-grass Sulphate of ammonia may suitably be mixed with superphosphate prior to application, but the mixing of it thus with basic slag should be avoided because of the undesirable chemical action which would result.

Harrowing of pastures during July is work which calls for attention if it has not already been carried out It is particularly necessary on fields which have been stocked heavily during May and June. Harrowing is of great value as a means of breaking up and distributing animal-droppings, and when this latter work calls for attention a section of chain harrow should be attached behind the portion used for its cultivating effect. Harrowing should be valued as a means of carrying out cultivation—cultivation which will aerate the soil, foster the development of feeding-roots in the better pasture plants, and tear out rubbishy matted growth. Such work done by harrows is analogous in its influence to the hoof cultivation that results from the trampling of stock, and that is of proven great value provided it is not overdone.

Suitable paddocks, preferably well-drained ones, provided with shelter and with herbage in which rye-grass is prominent, should often be closed up during July for the use later on of early-calving cows or early-lambing ewes. On such paddocks the rye-grass is of particular value because of its early growth under conditions of reasonably good drainage.

To avoid damage by poaching of the soil, paddocks which have become wet and soft should be used as little as possible. On such paddocks injury the influence of which persists permanently may be done if care is not taken to minimize poaching. Greatest damage is liable to occur by

neglect in this connection of recently-sown-down paddocks. Two rules that may be followed to prevent avoidable poaching are—firstly, if possible do not stock low-lying paddocks; and, secondly, feed out hay and roots on the higher, drier portions of the farm that often are also the poorer portions, the fertility of which will be usefully increased by such feeding.

Drainage in Grass-farming.

The value of good drainage in the production of annual and other special crops, such as lucerne, is unquestioned, but some are inclined to attribute less value to it on farms which depend largely upon grass. The true position is that adequate drainage has an important bearing on grass-land farming, for the following reasons:—

(*a*) It begets warmer soil conditions in the spring, which favour earlier growth of all the common pasture species, and so it provides greater growth at a critical time.

(*b*) It begets greater total annual growth, because it favours the more productive pasture species such as rye-grass and clovers.

(*c*) It results in greater returns from the use of suitable fertilizers and high-class seed.

(*d*) Because of its beneficial influence on the health and general thrift of stock it begets more efficient pasture utilization. Among the disorders which are lessened by good drainage are such serious ones as mammitis, foot-rot, tuberculosis, fluke, calving troubles, and parasitic worms.

Drainage is to be looked upon as an auxiliary rather than as an alternative to top-dressing.

On much of our poorly drained land mole drainage would unquestionably prove so effective and lasting in its influence as to be markedly profitable. This has been proved in actual practice by both sheep-farmers and dairy-farmers on this type of land. All the work attached to providing mole drains 9 ft. apart and 18 in. deep will be done by contractors at a charge of from £1 5s. to £1 7s. 6d. per acre, while a farmer using his own tractor will normally be able to do the work at a substantially lower cost, after having allowed adequately for interest, depreciation, material, and labour. Over extensive areas mole drains at a depth of from 14 in. to 16 in. serve excellently.

This is the recognized time of the year for giving attention to drainage. Apart from the actual work of constructing new drains, there are other important matters which frequently call for attention. Open drains, for instance, should be kept clear.

Mole- and tile-drain lines and outlets should be inspected after heavy rains in order to detect and locate any trouble in the working of the drains. All indications of want of drainage should be noted. Knowledge of such indications often is of value when any comprehensive drainage-work is being undertaken. Every opportunity should be taken to study the natural fall of the farm. Sometimes much drainage-work is rendered ineffective or unduly costly because the natural fall of the land is not properly understood when the work is being started. For instance, the running of mole drains across saucer-shaped depressions is likely to give trouble eventually even though the drains function for some time at least. It could usually be avoided by a complete knowledge of the lie of the land. Again, it is not advisable that the fall of a drain become less as the outlet is approached. Yet, because the general fall was not fully considered in the beginning, this is sometimes allowed to happen.

In carrying out mole drainage the natural slope of the land needs to be considered carefully, for if mole drains have too much fall they will scour in an undesirable manner.

Finally, emphasis may fittingly be placed on the need in drainage for sound planning and thorough work right from the start; if weakness creeps in it frequently is not easy to locate and almost always is costly to

rectify. The fact that the greater part of a drainage system is invisible makes it relatively difficult to estimate whether the system is acting as efficiently as it naturally should. From all this it follows that care, thought, and thoroughness should characterize drainage-work throughout.

It does not follow that because land is poorly drained it should not receive dressings of fertilizer. Indeed, in certain circumstances top-dressing of poorly drained land is definitely advisable. This arises from the fact that high fertility is requisite for success with such species as meadow foxtail, Poa trivialis, and timothy, species valuable for conditions so wet that rye-grass and cocksfoot would not tolerate them. At times top-dressing by raising the fertility to meet the needs of these species will prove distinctly profitable. Apart from such special cases, top-dressing of poorly drained land is frequently profitable, although it would probably be more profitable with better drainage.

At times it may not be practicable to provide thorough under-drainage. When this is so it is well to remember that surface drainage, which can sometimes be arranged relatively easily, is much superior to no drainage.

Some Aspects of the Liming Position.

In New Zealand liming grassland has produced very varying results. In some instances field results make liming appear an absolute necessity, while in other cases, which are probably more frequent, carefully obtained field evidence does not support the contention that liming is a desirable or a profitable proposition. Such widely differing results are only to be expected when one takes into consideration not only the greatly differing types of soil, but also the differing pastures and climates with which our farming deals.

Further, the position is complicated by the fact that it does not follow there is no influence of lime because there is no visible influence. It is held by many, including recognized authorities, that the benefits of lime are not easily detected directly. For instance, Professor Stapledon, Director of the Empire grassland research, says: "It is only occasionally and in very bad cases that liming actually adds to the bulk or weight of grass per acre, but it very frequently has a considerable influence on quality." This being so, it is unsafe to condemn liming because of absence of visible evidence of its influence.

Since it is not easy to judge directly whether liming is profitable or not the farming community would welcome some ready reliable means of finding out when liming would be justified. Various attempts have been made to meet the widely felt want in this connection. These attempts usually involve the use of what are termed "lime-requirement" or "soil-acidity" tests. There is in the minds of some the impression that certain of these tests will quickly disclose the amount of lime that may be applied to a soil with profit. This is not so. Probably the best statement on this point is that of Sir John Russell, the present Director of the Imperial Soil Bureau. He says: "Before any indication can be given of the amount of lime required for cultivation, it is necessary to make field trials." This statement completely disposes of the alleged claims of quick and easy tests.

Another important point is that circumstances are conceivable in which the use of lime would be beneficial and profitable but yet not desirable. This position would arise when the possible expenditure on a farm is strictly limited. In such circumstances the question may arise whether it is better to spend money on lime or on phosphates. The answer to be given would depend not on whether lime proves profitable, but on whether it proves more profitable than phosphates. A general indication of what form the answer would take in such a case may be gained from the fact that over this country as a whole the weakest link in the soil supply of

plant-nutriment is the content of phosphates. Hence, usually the step that should be taken first is one that will build up the soil in phosphates

When the use of lime will involve considerable outlay in cost of cartage or other transport, then it is important to bear in mind that 10 cwt. of burnt lime is equivalent in its influence on the soil to approximately 18 cwt. of ground limestone (carbonate of lime) Field trials indicate that when the two forms of lime are applied in the proportions of 10 to 18 the results obtained are equivalent

Guidance of some value in regard to the necessity of liming is provided by the following rule. If phosphates are definitely producing good results, then probably liming does not call for attention, but if the soil does not respond profitably to phosphates, then the lime factor is probably the weak link in the chain of factors giving fertility. There may be exceptions to this rule; the soil supply of available potash or of nitrogen may be the weak link, in which case it will be economically sound to apply, before liming is attended to, fertilizers supplying potash or nitrogen. But the exceptions to the rule are much less frequent than many believe.

Another practical aspect of the lime position is expressed by stating that if the funds available for expenditure on soil-improvement are strictly limited, then rectifying the phosphate position should be the first consideration; when this has been done liming may be given attention.

In general, relatively frequent small dressings of lime give better results over a number of years than would an equal amount of lime applied in one comparatively heavy initial dressing.

Stock-feeding in the July Period.

July is often a critical month in respect to stock-feeding, and particularly so in the case of pregnant ewes and cows. With these, scanty July feeding should be avoided if it is at all possible. Several of the recommendations in last month's notes on crop utilization are applicable during July. After the swede crop has been consumed carrots should be fed if available, mangels, having the best keeping-qualities, being reserved for the final root feeding of the season. Chou moellier, which is generally in good condition for feeding in July, should be utilized then, for at times in August it is inclined to bolt to flowering-heads. Autumn-sown cereals should be fed before the growth becomes too long; in general, two light feedings of short growth are more satisfactory and involve less waste than one feeding of heavy growth. Catch-crops that are to be used for green-manuring should be ploughed down during the coming month.

Tillage for Arable Crops.

July should in general be looked upon as a month in which to avoid the sowing of seed. Hence if land which is being prepared for wheat cannot be sown by about mid-June the sowing may well be held over until August, unless there is some special circumstance which calls for sowing at an unfavourable period, such as a sure glut of work later on which it will prove impossible to handle properly. What applies to wheat applies equally to the sowing of other cereals at this season.

Often during July the soil contains so much moisture that tillage work may readily be more injurious than beneficial. This is particularly true of heavy types of soil. If soil freely clings to boots or implements that have passed over a field, then generally it will be well to postpone cultivation of that field. Ploughing of grassland should cease when the soil is so wet that furrows are produced with a glazed-looking surface.

Except when soils are too wet, however, cultivation work should be proceeded with as speedily as possible. Wheat, oats, and peas are crops which often can profitably be sown early in August if the land has been suitably prepared for them.

—*R. P. Connell, M.A., Fields Division, Palmerston North.*

THE ORCHARD.

Pruning.

Apples.—The longer economic life of the fruit-producing parts in apple-trees allows of greater elasticity in pruning, and almost every orchardist has his own particular variations, all of which in the aggregate arrive at about the same point from a weight-per-acre viewpoint. The systematist carries a mental picture of the tree during the last fruiting-season, and from that aims to eliminate the undesirable features and build towards his conception of the ideal tree. The basic principles of pruning are dictated by the tree, and the pruner's efforts should be more in the direction of assisting than correcting nature if a continued battle between the tree and the pruner is to be avoided.

Soil-conditions play an important part in determining just how much wood may be left to carry fruit-spurs, for it is obvious that a tree which is having a hard struggle to find sufficient nutriment to maintain wood-production must be treated differently to one which is running riot after each pruning, indicating that it desires some other outlet for its abundant energy. It is not uncommon to hear that notwithstanding regular pruning some trees refuse to produce fruit, and, excluding varieties such as Northern Spy, which are slow coming into bearing, in most instances it will be found that all the thin laterals have been cut out because they did not look strong and the strong shoots cut back to the base because they threatened to get out of reach, with the result that being shorn of its outlet for energy and to preserve the balance between root and top the tree produces fresh wood and fruit-production suffers.

A good example of the inclination of the tree is obtained from one which has been left unpruned for a season It will be observed that in the first season strong clean shoots were made. In the second season many of these growths will flower at the tip and fruit-spurs will be formed at some of the eyes near the terminal extremity. On lateral bearers the spur-formation may occur during the first season. Following the spur-production fruit is carried and the wood-production decreases, and without sufficient stimulus, either in the form of pruning, manuring, or thinning, the tree will enter into a decline and eventually become an economic loss.

From this it will be seen that a certain amount of wood must be removed, and at this point the various systems and their modifications come into play. For the home orchardist a system of yearly extension and reasonable cropping offers fewest difficulties, and the more or less highly involved systems are best left to the professional grower who has his trees under constant observation and who can quickly resort to any corrective measures.

In every tree a varying number of main limbs or leaders are developed and terminally extended each year. Secondary shoots or laterals are added each season, and on these the bulk of the crop is carried. As the tree extends upward and outward more space becomes available and the leaders may be duplicated, but frequent duplication is not desirable, as there is a danger of the leaders loosing their identity, and the difficulties of pruning are greatly increased. Immediately below the point of last season's cut two or more shoots will have developed. Of these one must be selected to continue the lead, and is headed, removing about two-thirds of its length. During the next growing-season the uppermost eyes break into growth, and if too much wood was left the eyes on the lower portion will remain dormant and in time the limb will be a succession of fruitful and bare lengths. To eliminate the bare places the heading is regulated in that only sufficient is left to allow for the usual break and spur production peculiar to the variety. If the shortening is too drastic each eye is forced into

vigorous growth and fruit-production prevented. With the laterals, strong ones on the inside of the leader will be removed at the base, as also will any which challenge the leader for supremacy. This will result in the production of one or two weaker shoots at the point of removal. The light laterals are left uncut the first season and the older spurred twigs thinned or shortened as desired. Varieties which carry the bulk of their crop on the tips of the shoots require treatment which will permit the tree to follow its natural inclinations, for shortening the shoots removes an appreciable portion of the succeeding year's crop.

Jonathan represents a type which requires more severe treatment in order to frequently renew the fruiting-wood and maintain the necessary vegetative vigour Here it is preferable to work rather on the severe side in heading, all laterals may be shortened, and each season some of the older, partially exhausted fruiting-shoots removed, or if possible cut back to a weak shoot which is also headed, in order to stimulate growth beyond the fruit. This variety's fruitful habit and weak growth calls for careful treatment if a sturdy tree is to be developed. Opportunity should be taken to shorten every limb with a drooping tendency to an upright growth, and pruning to inside eyes is often advisable.

Citrus Culture.

Picking will be the most constant operation during the coming month. The usual heavy demand for lemons at this season is sufficient inducement to watch the crop very closely and gather everything that shows a tinge of yellow. It is often difficult to avoid gathering damp fruit, but the practice is not wise, and only dry fruit should be stored for keeping. The presence of moisture assists in the spread of fungal growth, and cases should be stacked to allow of free circulation of air and frequent inspection. Draughty stores are to be avoided, and a fairly warm room hastens the process of wilting prior to dipping. The slight wilt is important, as immersion of the turgid fruit in the hot bath is liable to rupture the oil-cells in the rind and induce decay.

Cottony cushion scale sometimes becomes active during the winter months and very early in the spring. Any colonies should be cleaned up without delay and trees showing *Capnodium* should be rigidly inspected. Citrus brown-rot may be expected during wet weather, and it is unwise to await its appearance before spraying with bordeaux.

Attention to drainage is vitally important to the citrus-grove, and the opening of temporary drains for the rapid removal of water becomes a routine matter. Of almost equal importance while the time is opportune is the topping or trimming of shelter belts or hedges which overhang or are higher than is necessary.

—*G. H. McIndoe, Orchard Instructor, Dunedin.*

POULTRY-KEEPING.

Feeding the Breeders.

A CORRESPONDENT has asked for advice in regard to feeding his prospective breeding-hens. He states that they are the pick of the late moulters which have produced heavily throughout the year, and he would like to know how to feed them in order that they may resume laying and their eggs may be available for the production of early-hatched chicks. The addition of such forcing food to the ration as meat, meat-meal, milk, &c., will tend to promote early laying, but I could not advise the adoption of this course. Obviously a bird which has just come through a heavy and forced laying-season, followed by the bodily strain entailed by the moulting

process, must necessarily be in a more or less exhausted condition, requiring a rest. It will not be in that vigorous condition necessary to produce eggs having a strong germ—the seed of good constitutional stock.

In selecting the breeding-hen it is not so much the egg-yielding capacity that should be studied as the power to transmit desirable qualities, and if a bird is not in the best of condition she will not be able to impress these qualities upon her offspring. It is certainly true that if a hen proves to be a persistent long-season layer she must possess a good constitution but where eggs for reproduction purposes are required it would be much wiser were she given an opportunity of regaining her strength by plain feeding, instead of forcing the time of production by means of a rich diet.

The Laying Type.

It is now quite an established fact that there is a laying type of fowl, and just as there is a desirable type of table bird, so there is also a type indicating by general appearance egg-laying capacity. As there are exceptions to every rule it sometimes happens that a bird of rather a different build to that looked for will prove to be highly profitable This does not prove that the laying-type theory is not correct, but rather that our knowledge of it is not as extensive as it should be, particularly when applied from a breeding standpoint.

Many who are now realizing the value of a particular type as indicating laying-power are naturally—with that enthusiasm common to progressive poultrymen—looking for anything which will guide them in their search for knowledge on this subject. It may be that they happen on photographs of birds published to illustrate type and the exceptions mentioned. I would urge poultry-keepers not to place too much reliance on such photographs, for probably there is no domestic bird or animal which when photographed illustrates its true type less than the fowl. It is common for a photographer to wait patiently for hours to secure a good picture of a high-type layer, and then not succeed. On one occasion I tried to obtain a faithful picture of a champion layer, and the three photos secured were so different one from the other that any one unacquainted with the facts would have refused to believe they were of the same bird. Sometimes it is possible to picture a bird by means of the camera just as it should appear, but more often than not a photo of a fowl gives a flat contradiction to the saying that the camera cannot lie. It is therefore well not to attach too much importance to photographic reproductions in judging type.

In regard to laying type the main point to be considered is the securing of breeders, and the fact that a freak type bird may prove to be a good layer is no guarantee that its descendants will be equally good layers If used for breeding purposes the progeny of such a bird will probably be of all shapes and sizes, with nothing to distinguish them for production capacity. The aim of all successful breeders, no matter what the class of stock, is to develop if possible a uniform type of animal in flocks or herds from which they are breeding. Type is the first essential, and uniformity in that type is the next consideration.

With fancy poultry—that is, any breed conforming to approved fancy standards—it is easy enough for the breeder to judge the quality of a bird; but with utility poultry, when egg-production is the chief consideration, it is difficult for any one to judge the quality unless there is a standard laying type from which to work. Very much importance attaches to the question of a utility standard. It is not every one who has a natural eye for form, and even men who have had long and successful experience with utility poultry quite often fail in picking out the laying type; whereas with a definite recognized standard with points apportioned for each desired quality it is possible to attain fair success after patient study and sufficient experience. It must be admitted, however, that no matter how perfect

the system adopted (and the most satisfactory method is by awarding points for essential qualities) the judging of fowls is more or less a natural gift. In setting the desired standard the man who has a natural eye for the laying type can indicate how his judgment has been arrived at.

The Impending Hatching-period.

Where a good egg-yield is desired during the late autumn and early winter months (which should be the case on all plants if a maximum profit is to be made) the chickens which are to produce these should be hatched out by the end of July or early in August. The poultry-keeper who has neglected to have everything in good order preparatory to this important period will now suffer the results of his neglect. While it is never advisable to breed from pullets if hens can be obtained, the fact remains that on most plants there will be insufficient adult birds in the necessary productive condition to enable a desired number of chicks to be hatched out at this period of the year. Hence breeding from pullets must be resorted to. Where it is necessary to use pullets they should be well-matured birds hatched in the early spring, and be the progeny of hens, not pullets. It is far better to delay hatching operations than to breed from late-hatched or poorly-developed pullets.

Where the natural mother is depended upon the drawback to timely hatching is becoming more acute each year, owing to the difficulty of securing broody hens when required. As the laying type develops the broody tendency weakens, so that the more profitable the stock from an egg-laying point of view the greater will be the difficulty in obtaining broody hens. The most popular bird at the present time is the White Leghorn, and with the best-laying types of this breed broodiness has almost disappeared. Where the plant is a small one and an incubator is not used the difficulty is a serious one. There are two alternatives—either to have eggs artifically hatched by persons who have the necessary plant, or, better still, to secure stock as day-old chicks from a breeder of repute.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Winter Work.

Spare supers that were left on the hives should now be removed—where it can be done without unduly disturbing the cluster—and the bees confined to the brood - chamber. In the northern parts of the Dominion breeding will start in colonies of normal strength at the latter end of July, and every effort should be made to make the bees snug so as to promote breeding. Where the bees have taken to the supers entirely the bottom story is the one to be removed.

During the dormant season mice are likely to make themselves troublesome in the apiary. They attack the stores, and otherwise destroy the combs. Many colonies are by this means reduced to the verge of starvation by the spring. It is the work of only a few minutes to examine the hives, and where gable roofs are adopted the mice-nests will usually be found on top of the mats. To obviate this trouble the entrance should be contracted.

Control of Wax-moth Pest.

In districts where wax-moths are troublesome, particularly the large one (*Galleria mellonella*), a periodical examination should be made of all extracting combs. These moths do an enormous amount of damage, particularly in the off season, and especially in districts where mild weather

conditions prevail. The moths not only attack the dry combs, but also combs of honey stored for spring feed.

Where the moth is prevalent in large numbers a special comb-room is essential, constructed so as to be nearly airtight and filled with racks on which to suspend the combs to enable fumigants to penetrate the cells. Where only a few combs have to be dealt with these may be stacked in supers, spaced eight to the super, care being exercised to see that the junctions of the boxes are made smoketight by pasting a strip of paper round them. The top box of the pile should contain no frames. Into this place an iron saucepan containing wood embers, and on these throw a small quantity of sulphur. Close the supers securely, and keep closed for a couple of days In three weeks to a month a second fumigation should be given.

Bisulphide of carbon may be used to accomplish a similar result. In using this chemical the combs can be stacked in a tight box or supers. If the latter are used all cracks require to be closed with paper pasted on the outsides to prevent the fumes from escaping. Place a quantity of the bisulphide in an open dish on top of the combs The liquid evaporates and the fumes, being heavier than air, settle over the combs, thus effectively killing the moths. This operation may have to be repeated during the winter months. Great care must be exercised when using the bisulphide, as it is highly explosive and dangerous, and on no account must a fire or light be allowed near the liquid when being used

During the past two seasons Cyanogas (calcium cyanide) has been very successfully used in destroying bees by Apiary Instructors whose duties have called for the destruction of diseased colonies preparatory to burning. The active agent of calcium cyanide is liberated in the form of hydrocyanic-acid gas. which is a most deadly poison to all life However, it can be used with safety because the liberation from the powder of the gas is slow, thus allowing the operator to retire after giving a charge. Fumigation of combs may be done in supers, after taking the precaution of making them gas-tight, in the same way as when using sulphur or bisulphide. In the event of a comb-room being used the supers containing the combs can be stacked criss-cross or placed on the racks usually provided. No other preparation is necessary. In operation the calcium-cyanide powder should be sprinkled on paper and placed under the tiers of supers or here and there about the buildings. For super-fumigation it is recommended to use a dose of 4 lb. to 100 cubic ft. of space. Half the quantity will suffice for airtight comb-rooms. These dosages will kill the moths in all stages. As already indicated, the gas, being deadly to all life, must be handled with great care. The writer has used calcium cyanide in the open air for killing bees and has watched its deadly results. Caution, however, is necessary when the chemical is used in buildings. The operator should leave the building as soon as possible, and lock the doors and windows. Twenty-four hours' treatment will suffice, after which the door of the room should be opened to allow the gas to escape, the building not being entered for from two to three hours.

Plans for next Season.

The off season is the best time to make plans for the following season. The beekeeper should decide what increase he desires to make, and should prepare accordingly. Making up hives and frames is exasperating work if left till the bees are in urgent need of room, and it should be finished long before the actual time for increasing one's stock arrives. The beekeeper should also face the question of providing himself with stocks of foundation, and make arrangements for the treatment of his surplus wax by some neighbouring maker of foundation. He should also decide on which market to place his crop, and lay his plans accordingly. It is advisable, too, that he consider the theoretical side of his occupation, and study, while the bees

are in a dormant condition, the best methods of improving his stocks. Neither weather conditions nor locality nor any other factor will influence the honey-crop so much as strong colonies of bees, and the apiarist should endeavour, while he has the time, to ensure that these shall be in existence during the coming summer.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Diseases and Pests of Small-fruits.

PLANTATIONS of this class are frequently found infested with diseases and pests. To control such attacks and improve the crops demands careful study now and energetic action in the very near future. Many specimens are received of raspberry-cane infected with rose-scale, wilt disease, leaf-spot, bud-moth, and anthracnose; also currants, gooseberries, strawberries, and loganberries with some of the same or similar troubles. Good crops of a fine sample may only be grown where an understanding interest is taken in these fungous and insect parasites, in addition to good cultural treatment, as was suggested in last month's notes.

The best time to attack these troubles is in summer-time as soon as the crop is gathered. Raspberry and loganberry canes should then be cut off at the surface of the ground and carried out and burnt, thus disposing of what is generally a large mass of material that is more or less infected. To leave stubs 3 in. to 4 in. long at this pruning is a mistake, as such portions are usually in the worst condition of any part of the old canes. With the removal of these old canes and young weak canes that are unprofitable the remaining growth is exposed to the air and sun to ripen, and may be easily given at once a series of effective chemical sprays to clean them up or prevent the attack of disease. Strawberry-beds may then have the old infected foliage mown off and burnt. The new autumn growth may afterwards be sprayed to destroy the spores of leaf-spot and brown-rot. The performance of summer pruning of currants and gooseberries provides similar opportunities for effective autumn spraying.

Where this treatment has been given in a thorough manner and the bushes have been properly winter-pruned and well manured, the prospects of a good crop should be very bright. However, as the bushes and plants commence to make new growth in the spring they should be given suitable spray treatment and carefully examined occasionally and any new developments noted. Where the summer treatment has been omitted the spray treatment now and on until fruiting-time will be the more urgent. Most of the fungus diseases may be controlled by applying bordeaux 4–4–40 as soon as growth commences, and repeating it, as may be necessary, at intervals of about two to three weeks. For the control of bud-moth of raspberries and loganberries arsenate-of-lead powder, 1 oz. to 4 gallons ($\frac{3}{4}$ lb. to 50 gallons), should be added, first working it up with a little water into a cream before adding it to the bulk of the spray. This little caterpillar spends the summer feeding on the "receptacle" of the fruit, where he does little damage, but after hibernating in the ground he emerges in spring to climb the canes and burrow into the buds. The damage thus caused is sometimes extensive, and may be avoided by a timely application of arsenate.

The very common borer of black currants and gooseberries is at this season hibernating, and does not emerge until midsummer, when it does so in the form of a moth. Arsenate sprays would then be beneficial, but for the present the only check available is to cut out the old wood and burn it with the larvæ it contains

The rose-scale, so common on raspberry-canes, is most effectively controlled by cutting low and burning the old wood in summer, thus reducing the autumn brood. In spring-time as soon as the young insects appear they may be readily destroyed by spraying with a good contact insecticide such as Black Leaf 40, using 1 part to 1,200 parts of water (1 pint to 150 gallons). It is very important to first dissolve 3 lb. to 4 lb. of good soap to the 100 gallons of water before adding the nicotine.

The Indoor Tomato Crop.

Tomato-plants now being raised for glasshouse planting should be well aired at all suitable opportunities. To rush them up big and soft gives a false appearance of vigour, and when planted out they are an easy prey to a cold snap. This plant demands a dry buoyant atmosphere, and this should be given whenever possible without chilling them. The plants are then perhaps not quite so big, but well rooted and hardy — a condition most favourable for resisting unavoidable low temperatures or any other troubles they may have to meet.

The soil under glass is sometimes allowed to become " bone dry " during the winter, and plants are sometimes planted out with the soil in such a state or nearly so. This is a serious mistake. In such a case—in fact, generally—the land should be thoroughly irrigated some time before planting takes place, so that all stickiness may disappear before that operation. If the plants are then firmly set in open furrows they may easily be given the little further watering required before the weather warms. When planting this or any other crop carefully scrutinize every plant and reject every one that is weak, diseased, or abnormal in any respect. It is only in this way that a strong even crop may be grown.

The Market-garden.

The cost of manures and the scarcity of those of an organic nature demand careful consideration if they are to be used with economy and best effect. It is not uncommon to find them used to excess; heavy green crops or dressings of stable manure are turned in annually, and the soil becomes overcharged with humus and nitrogenous matter. If the land is heavy and not very well drained, the position may then become serious. A heavy attack of collembola mites and millepedes feeding on the roots are the least of the troubles which threaten the crop. Unless the land is very light or deficient in humus a heavy dressing of organic manures once in three years should be sufficient. This should be supplemented by phosphates, and artificial fertilizers used during the intervening period.

Immediately after the heavy dressing cabbage, cauliflower, leeks, and green crops generally may be grown, followed later by deep-rooting crops such as carrots and parsnips, and these again by shallow-rooted crops such as potatoes, onions, tomatoes, and salads. By observing some such rotation the resources of the land are exploited most economically, and disease starved out by the crops which follow being generally resistant to the troubles which affected those which preceded them.

In the middle and northern districts of the Dominion hardy vegetation will commence to make new growth during the coming month, and on land that is well drained a start may be made with the new season's planting operations. Plants of lettuce, onions, cabbage, and cauliflower held in winter beds may be set out, and pickling shallots, garlic, rhubarb, asparagus, and early potatoes planted. Sowings may be made of asparagus for planting out next spring (to be started early so that good big plants may be obtained), early peas, broad beans, early turnips, cabbage, cauliflower, spinach, and salads; also onions in the drier districts where spring sowing is practised.

Mushroom-culture.

Numbers of inquiries are being received regarding the cultivation of mushrooms, and they are evidently becoming a popular vegetable. Those who purpose to grow the plant should remember it is a saprophytic fungus requiring humid conditions in a temperature of 50° to 65° F Under natural conditions these exist during the autumn months, and an old pasture completes the necessary requirements. Such a pasture may be planted with small pieces of the plant---known as mushroom spawn—and a crop may be gathered without much trouble. In that case the method would be to remove a piece of turf about 1 ft. square, also 4 in. to 5 in. of soil from below it. In the hole place a quantity of moist fermenting stable manure that has been specially prepared, and in the centre of this a piece of spawn about the size of a small hen-egg. Firm it well with the foot and replace the turf, beating it down as firm as possible. This may be done any time during the summer, but the material should not be allowed to dry out.

Under artificial conditions the fungus may be grown at any season of the year where the necessary conditions are provided. Sheds and old mines are often mentioned in literature on this subject, as it is under such conditions that the necessary temperature and humidity may easily be obtained at all times, and the absence of light is no detriment to this plant, which obtains its nourishment from decaying vegetation. In the open, low temperatures have to be avoided, and under glass high ones would be just as detrimental; but where ample ventilation is provided cucumber-houses could be used for the purpose, and in some cases a crop might be grown on the ground beneath the plant-stage of a glasshouse.

Experiments have been carried out with other materials, but so far nothing has been found equal to strawy stable manure as a medium for growing this crop. The material must be brought to a state that is moist and evenly fermenting throughout, as in the making of a hotbed. It may then be made up into beds of a convenient width and any length, and packed firmly to a depth of about 12 in. When the heat has subsided to a temperature of 70° F. the material should be spawned—that is, planted. When the plants have commenced to run and a mould-like growth has developed (about seven to fourteen days after planting) the bed should be covered with an inch or two of fine light soil that has been passed through a sieve, and made firm with the back of a spade. This soil should be kept moist by watering from a can with a fine rose. In six weeks the beds should commence to crop, and may be expected to continue to be profitable for three to four months. The material should then be removed, and it is most valuable as a manure for the garden or compost heap. Where sheds are used the beds are sometimes made on boarded tiers about 3 ft. one above the other.

The greatest cleanliness is necessary for growing the crop successfully, as this parasitic plant may easily become a victim of other parasites and great loss be incurred through disease. Adequate ventilation is also necessary, and it must be carefully regulated to avoid temperatures that are either too low or high.

—*W. C. Hyde, Horticulturist, Wellington*

Importation of Fertilizers in 1929–30 Correction.—With reference to the statistics published in last month's *Journal*, the Customs Department advises that owing to an error in description in the import entry an amount of 700 tons of Egyptian phosphate, valued at £2,391, imported at Invercargill, was stated as "phosphate not otherwise specified," from the United Kingdom. The relevant figures in Tables 1, 2, and 3 on pages 339–40 of the *Journal* should be amended accordingly, the total importation of Egyptian phosphate becoming 1,000 tons, value £3,415

REVIEW.

Fungous Diseases of Plants, Jakob Eriksson (2nd edition, English translation by W. Goodwin), vi + 526 pp., 399 illustrations. Bailliere, Tindall, and Cox, London, 1930. £1 15s. net.

THIS book covers the major bacterial and fungous diseases of agriculture, horticulture, and forestry. Diseases are grouped according to the family or order to which the causal organism belongs, and under each is given brief notes on the symptoms, life-history, and remedial treatment. Symptoms of many diseases are illustrated by half-tones or line drawings, and fructifications of many of the pathogens are shown by line drawings.

As a general text-book purporting to cover modern knowledge of plant-diseases this work is most disappointing. The arrangement of diseases under groups of pathogens makes the book difficult to handle (the host index in the appendix being of little aid); the text is often archaic, and appears to have undergone little alteration since the first edition was published in 1912, for one gains the impression that the author has disregarded most recent literature. An annoying feature is the frequent reference in the text to authors not cited in the bibliographies following each disease.

The author persists in his mycoplasm theory, and extends it from the rusts to cover late blight of potatoes (*Phytophthora infestans*) and downy mildew of spinach (*Peronospora Spinaciae*), and, unconsciously perhaps, permits it to permeate the whole work; and this despite the constant criticisms to which the theory has been subjected from the time of its promulgation (1897), and failure of any one else to obtain evidence in its support. He still adheres to his earlier views concerning species in the rust fungi, as in the book one finds reference to *Puccinia Phleipratensis*, *P. bromina*, *P. Symphyti-bromorum*, *P. holcina*, *P. Triseti*, *P coronifera*, *P. Poae-alpinae*, &c. Some of these are merely biologic forms of the common cereal rusts, and others are recognized only by the author.

That the author's taxonomy requires revision is indicated by the use of names now obsolete, such as *Ustilago nuda*, *Puccinia simplex*, *Uromyces caryophyllinus*, *Phragmidium subcorticium*, *Polyporus* (for *Fomes*), *Phoma oleracea*, *P. Napo-brassicae*, *Sporodesmium Solani*, *Rhizoctonia violacea*, *Mycosphaerella pinodes*, &c.

In the sections dealing with control are many recommendations that are quite impracticable, others erroneous, and others again apparently suggested because of the author's persistence in his mycoplasm theory. Thus Uspulun or Germisan is recommended as a substitute for hot water in the control of loose-smut of wheat and barley; barberry eradication is considered to be of doubtful value, removal of grasses in the vicinity of cereal crops is recommended in the control of cereal rusts; avoidance of seed from infected crops appears to be a favourite recommendation; while for the control of leaf-curl of peach-trees painting the trunks with a mixture of clay, dung, lime, and carbolineum is advised. One can picture, too, the conscientious farmer following instructions for the control of *Sclerotinia sclerotiorum*, down on his knees in a 10-acre field of Jerusalem artichokes carefully picking up by hand all sclerotia!

G. H. C.

Noxious Weeds.—Two plants have been added to the Second Schedule of the Noxious Weeds Act—which comprises noxious weeds when so declared by a local authority—namely, stinking mayweed (*Anthemis cotula*) and convolvulus (*Convolvulus arvensis* and *C. sepium*, both species).

WEATHER RECORDS: MAY, 1930.

Dominion Meteorological Office.

General Notes.

The relatively dry weather which had ruled since the beginning of February continued into May until the middle of the month. The first half of the month, owing to a persistence of anticyclonic pressure, was remarkably fine over the whole of the Dominion, with clear mild days and cool nights.

Low-pressure waves crossed southern New Zealand during the nights of the 13th and 14th, but as they were of slight intensity the rainfall accompanying them was confined to the western districts of the South Island. On the night of the 15th, however, a secondary depression of cyclonic form developed west of New Zealand, and on the morning of the 16th was centred west of Farewell Spit. Fairly general rain set in at this time with heavy falls in places, particularly from Nelson and Marlborough northwards. By the morning of the 18th this cyclone had passed away eastwards, and. since at this time an extensive anticyclone covered the whole of Australia and the Tasman Sea, indications appeared favourable for the development of another lengthy spell of fine weather. From the 18th onward, however, until the close of the month there was a remarkable frequency of depressions of the westerly type, which moved along the southern edge of the anticyclone. As a consequence strong and squally winds between west and south-west prevailed during this period, and there were many rapid and severe weather-changes. On the 20th, 21st, 26th, 27th, and 29th, there were sharp southerly changes, and thunder and hail occurred at places, while snow fell frequently on the highlands and in the South Island on parts of the lowlands.

Although considerable rain fell after the middle of the month, the total for the whole month was everywhere below the average, except in the south-west corner of the Dominion, where a slight excess occurred.

The cold of the latter part of the month and the frosty nights during the first half had an adverse effect on pastures. Consequently, though stock remained on the whole in good condition, supplementary feeding had to be resorted to in some districts. The rain, too, came too late to cause any appreciable response in growth of vegetation, so that the outlook for winter feed from pastures is far from encouraging, more particularly in the eastern districts. On the other hand, it permitted the carrying-out of agricultural work which had been seriously retarded by the prolonged dryness of the soil.

Rainfall for May, 1930, at Representative Stations.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	1·17	8	0·26	5·06
2	Russell	0·95	10	0·54	5·92
3	Whangarei	1·65	16	0·44	7·84
4	Auckland	2·74	17	0·99	4·50
5	Hamilton	2·63	12	0·73	4·54
5A	Rotorua	..	..	..	5·72
6	Kawhia	3·24	12	0·51	5·57
7	New Plymouth	4·63	13	2·67	6·23
8	Riversdale, Inglewood ..	5·91	14	3·02	9·82
9	Whangamomona	3·27	8	1·23	7·05
10	Eltham	3·70	9	0·67	5·27

RAINFALL FOR MAY—*continued.*

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
	North Island—continued.				
		Inches.		Inches.	Inches.
11	Tairua	1·40	12	0·34	7·64
12	Tauranga	2·11	8	1·50	5·16
13	Maraehako Station, Opotiki	0·60	5	0·40	5·70
14	Gisborne	1·10	5	0·86	5·67
15	Taupo	1·49	7	0·63	4·09
16	Napier	0·77	7	0·48	3·74
17	Hastings	0·57	5	0·20	3·33
18	Taihape	1·84	12	0·51	3·84
19	Masterton	1·71	14	0·34	4·03
20	Patea	2·56	10	0·68	4·34
21	Wanganui	1·50	9	0·36	3·42
22	Foxton	1·35	9	0·32	2·78
23	Wellington (Karori Reservoir)	2·68	9	0·89	4·40
	South Island.				
24	Westport	4·06	14	0·88	8·35
25	Greymouth	6·39	14	1·35	8·01
26	Hokitika	7·00	13	2·36	9·71
27	Ross	8·57	12	1·79	9·73
28	Arthur's Pass	5·53	8	1·61	11·02
29	Okuru	11·40	15	3·70	11·60
30	Collingwood	..	..	..	10·18
31	Nelson	2·53	7	0·95	3·08
32	Spring Creek	2·21	5	1·95	3·19
33	Tophouse	3·88	10	1·42	5·94
34	Hanmer Springs	1·79	9	0·70	4·51
35	Highfield, Waiau	..	..	..	3·41
36	Gore Bay	2·24	13	0·57	3·83
37	Christchurch	2·04	11	0·67	2·65
38	Timaru	1·20	9	0·44	1·41
39	Lambrook Station, Fairlie	1·12	3	0·60	1·53
40	Benmore Station, Clearburn	1·41	8	0·61	1·97
41	Oamaru	0·86	9	0·42	1·61
42	Queenstown	2·77	10	1·16	2·63
43	Clyde	1·10	5	0·58	0·97
44	Dunedin	1·79	14	0·38	3·23
45	Wendon	2·01	11	0·40	2·23
46	Gore	2·52	18	0·64	2·71
47	Invercargill	5·00	25	0·60	4·46
48	Puysegur Point	6·88	27	1·05	6·81
49	Half-moon Bay	5·50	21	0·89	4·50

—*Edward Kidson, Director of Meteorological Services, Wellington, 6th June, 1930.*

BOOKS RECEIVED.

THE CROP-GROWER'S COMPANION, by John Porter, B.Sc., N.D.A., N.D.D., Head of the Agricultural Education Department and Lecturer in Agriculture, Bucks County Council. Gurney and Jackson, London; Oliver and Boyd, Edinburgh, 1929. Price, 8s. 6d net

THE SOYA BEAN AND THE NEW SOYA FLOUR, by C. J. Ferrée (revised translation from the Dutch by C. J. Ferrée and J. T. Tussaud). William Heinemann (Medical Books), Ltd., London, 1929. Price, 6s. net.

THE REGISTER OF VETERINARY SURGEONS, 1930. Royal College of Veterinary Surgeons, London. Price, 5s.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

ABORTED COWS AND SPAYING.

"SUBSCRIBER," Whangarei :—

I should be pleased to have your advice concerning the following: I have had three cows affected with abortion, one having slipped twice in succession, and have decided to have them spayed Would it be advisable to wait until all traces of discharge have vanished before having this operation performed ? Also, how soon after spaying could the cows be put with the remainder of the herd (as they are in milk) without fear of infecting the others ?

The Live-stock Division :—

It certainly would be advisable to have the cows free from all discharge before having them spayed, as there might be a chance of infection after the operation and septic peritonitis being set up As this is not very likely, however, we consider that the operation might be performed any time after six weeks Referring to your second question, if any cow that has aborted is isolated from the milking-herd for two or three months, then you may be fairly certain that she is not a channel of infection.

KOHLRABI FOR STOCK-FEEDING.

Inquirer," Otautau :—

Please give me some particulars of the feeding qualities of kohlrabi. How does it compare with rape for lamb-feed and swedes for cattle-feed ? How is it sown—in ridges or on the flat—and what quantity of seed per acre is used ?

The Fields Division :—

Kohlrabi is the equal of good swede for feeding and fattening purposes, but the leaves cannot be considered quite as good as rape. Usually it is grown for the bulb, which matures in much the same way as the swede, hence the leaves would not be mature or quick-growing enough to take the place of rape. A good crop of kohlrabi will yield almost as much as swedes In good swede land a yield of 30 to 40 tons per acre can be expected. Sowing should be done in 26-in. ridges, as for swedes, using preferably 2 lb. of seed per acre. The plots can then be thinned and hoed in the same way as for swedes. Manuring is the same as for swedes in different localities. Kohlrabi usually contains a little less water than swedes, the average being about 88 per cent ; the dry-matter content is therefore comparatively high. This plant is often called the turnip-rooted cabbage, and in Continental countries is often transplanted in the same was as cattle-cabbage. Its outstanding feature is its drought-resisting qualities In districts where autumn droughts are common kohlrabi will often produce a heavier crop than swedes. It withstands hard frosts well, and is considered by some farmers and growers to be superior to swedes in this respect

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CRACKING OF PEARS.

"SUBSCRIBER," Huinga :—

I have a couple of pear-trees which bear fairly well, but a big proportion of the fruit cracks, more especially the fruit on the lower branches Could you inform me of the reason and what steps should be taken to prevent the cracking.

The Horticulture Division :—

The usual cause for pear-fruit cracking is a fungous disease commonly known as black-spot. Some varieties are very susceptible to the trouble and difficult

to keep clean in certain localities The best preventive is a bordeaux spray made and applied in the manner described in the Department's Bulletin No 77, "The Home Orchard," a copy of which has been forwarded to you.

THE TREE STINGING-NETTLE AND FARM-ANIMALS.

G H. MONRO, Havelock :—

Can you inform me whether any instances are known of calves dying as a result of contact with the tree stinging-nettle? I have known of cases of dogs becoming extremely ill from this cause, and one case of a slut, suckling pups, which died from being stung by the nettle

The Live-stock Division :—

No cases of deaths among calves from nettle-sting are on record Dogs are more sensitive to the effect of the acid from the nettle It is improbable that even severe stinging by the tree-nettle would cause deaths in calves, on account of their less sensitive skins Severe lesions of urticaria may be set up, especially in the vicinity of the natural openings of the body. In this connection very considerable swellings may be noticed round the eyes and muzzle Depending on the amount of nettles present so will precautions be necessary to prevent a serious infection with the acid of the plant In the case of young calves it would be advisable to fence off the nettle area if possible

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GROUND LIMESTONE AND GROUND BURNT LIME.

W. D. WILLIS, Greatford :—

Would you kindly advise me upon the relative merits of burnt lime and ground lime as a top-dressing for a property which last year received 3 cwt. basic slag, followed by 1 cwt. sulphate of ammonia. Although burnt lime is very unpleasant to handle, I am prepared to use it if worth while

The Fields Division :—

It may be explained that both forms of lime are on the market as "ground" lime, and the term is confusing unless specified as "ground limestone" or "ground burnt lime" Their relative values as soil-improvers are virtually the same, provided consideration is given to the proportion of calcium (pure lime) that each contains. For instance, ground limestone (unburnt) contains about 54 per cent. calcium, whereas ground burnt lime contains about 100 per cent. In other words, if you decide to lime your land by applying, say, 1 ton of ground limestone per acre, you would require only approximately 11 cwt of burnt lime per acre, to give the same amount of pure lime per acre Other important considerations are cost of transport, convenience in handling and storing, and soil-type Should the farm be far distant from the rail, transport of approximately double the quantity of ground limestone to burnt ground lime may be an important economic consideration. Burnt ground lime is not pleasant to handle, corrodes the ironwork of implements, and as it absorbs moisture from the atmosphere it bursts the sacks in which it is stored and is generally unpleasant. While ground limestone is more bulky to handle and in consequence more costly to transport, it has none of the unpleasant handling-qualities of burnt ground lime, and can be applied to almost any type of soil without harm, whether heavy clays or light sandy soils, and where necessary with good effect, whereas burnt ground lime should never be applied to light soils or soils short of humus Fineness of grinding is an important factor in the efficiency of ground limestone

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Chilean Nitrate Organization. — The delegation of the Chilean Nitrate Producers' Association for Australia, New Zealand, and Pacific Islands, which was suspended a year or two ago owing to economic difficulties, has been re-established, with headquarters at Sydney as previously. Mr. Alfred E. Stephen, F I.C., has resumed the position of delegate in charge.

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Agricultural instruction. Direction of experimental areas and co-operative experiments. Farm economics. Investigation and advice in agrostology, plant-pathology, entomology, and agricultural botany. Identification of economic-plant specimens, insects, &c. Seed-testing. Certification of seed potatoes, seed wheat, and grass and clover seeds. Hemp-grading for export, and instruction in milling. Grain-grading. Plant Research Station, Palmerston North. Ruakura Farm Training College.

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PUBLICATIONS SERVICE.—Editor: R. H. Hooper.

Edits and issues the *New Zealand Journal of Agriculture*, bulletins, reports, and other publications of the Department.

STATE FARMS.

Ruakura Farm of Instruction, Hamilton.

HEAD OFFICE AND DIVISION AND SECTION HEADQUARTERS AT WELLINGTON

(Except Fields Division, Palmerston North).

BRANCH OFFICES AT DISTRICT CENTRES.

WHEAT AND OATS THRESHINGS.

TABULATED below are returns of threshings of this season's wheat and oats crops received by the Census and Statistics Office up to 19th May, covering the period January-April, 1930:—

Land District.	Wheat					
	Firsts.			Seconds.	Total threshed.	Average Yield per Acre.
	Tuscan or Longbury.	Hunters (Varieties)	Pearl or Velvet			
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels	Bushels
Gisborne ..	480	..	..	..	480	30·00
Hawke's Bay ..	10,267	3,266	..	1,013	14,546	32·84
Wellington ..	49,626	8,128	15,998	3,157	76,909	39·10
Nelson ..	8,262	12,058	380	1,489	22,189	23·73
Marlborough ..	65,716	17,112	1,249	5,124	89,201	29·46
Canterbury ..	3,753,104	829,035	257,380	182,638	5,022,157	30·63
Otago ..	341,375	170,907	132,631	39,191	684,104	34·08
Southland ..	58,631	3,809	8,053	1,764	72,257	42·98
Totals ..	4,287,461	1,044,315	415,691	234,376	5,981,843	31·14

Land District.	Oats.					
	White.	Dun.	Black.	Algerian.	Total threshed.	Average Yield per Acre.
	Bushels.	Bushels.	Bushels.	Bushels	Bushels.	Bushels.
Gisborne ..	..	..	..	252	252	42·00
Hawke's Bay ..	192	..	..	9,298	9,490	42·68
Wellington ..	2,553	760	404	21,318	25,035	41·73
Nelson ..	180	..	..	5,742	5,922	28·61
Marlborough ..	4,269	1,442	280	16,885	22,876	33·22
Canterbury ..	590,023	113,240	13,494	188,046	904,803	38·09
Otago ..	568,041	35,789	21,380	53,353	678,563	52·65
Southland ..	684,555	18,711	3,940	..	707,206	58·83
Totals ..	1,849,813	169,942	39,498	294,804	2,354,147	46·74

STOCK SLAUGHTERED, 1929-30.

FOLLOWING are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary registered slaughterhouses throughout the Dominion during the year ended 31st March, 1930:—

Stock.	Abattoirs	Meat-export Slaughter-houses.	Bacon-factories	Ordinary Slaughter-houses.	Totals 1929–30.	Totals 1928–29.
Cattle ..	146,050	138,467	..	78,451	362,968	403,330
Calves ..	45,165	393,513	..	1,696	440,374	394,987
Sheep ..	580,115	2,598,510	..	241,657	3,420,282	2,980,066
Lambs ..	107,533	6,462,783	..	24,319	6,594,635	6,149,482
Swine ..	141,208	279,230	38,170	27,299	485,907	470,493

—*Live-stock Division.*

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CONTROL OF WEEDS BY SODIUM AND CALCIUM CHLORATES.

FURTHER INFORMATION AND ADVICE

J. W. DEEM, Director, Fields Division, Department of Agriculture.

AN article by the writer on the use of chlorates in weed control, especially in regard to ragwort, was published in the May issue of the *Journal*. Considerable interest in the subject has been created, and various statements and claims are being made in reference to the discovery and use of these chlorates for weed destruction. The position is that most of the chlorates have been under test for several years as agents for weed-control, and the general results, particularly in France and America, go to show that the most effective work is being done by sodium and calcium chlorates.

The attention of the Fields Division was particularly directed to the use of these chlorates some eighteen months ago by reports of experiments carried out in the United States for the control of bindweed (convolvulus) by means of spraying with sodium chlorate. This suggested the possibilities of chlorates for the control of some New Zealand weeds, particularly ragwort and similar plants. We also learned that calcium chlorate was being tested in Australia by the Victorian Railway Department for the control of weeds on the railways. Inquiry was made from the authorities in Melbourne, and their report was so favourable that we decided to give both chlorates a trial. Half a ton of the sodium and a small drum of the calcium was secured, and experiments were started as related in the previous article.

Ragwort being a weed that was causing farmers great trouble received most attention, although small experiments with other weeds were carried out, with the result that we found that most soft weeds were destroyed by one application, while the harder weeds, such as Californian thistle, blackberry, &c., were greatly weakened. At the present time there are indications that three sprayings have killed patches of Californian thistle; but we shall require next seasonal experience before making a definite statement regarding this wa… The same remarks apply to blackberry. Quite a number of est… ments are under way this year with various weeds, and so … anything definite in regard to any particular weed is avai…

information will be given due publicity. It may be mentioned here that Scotch thistle, which does a great deal of harm in good pastures by spreading out and smothering the grass, and which is costly to grub, is easily controlled when in the rosette stage by a spraying of sodium chlorate.

We do not look upon sodium chlorate as a " kill-all," but apparently there are many people who have got the idea that if it will kill ragwort it will kill most things, and we have had inquiries from all over New Zealand asking if the chlorate will kill couch, rushes, gorse, piripiri, &c. Up to the present we have not been able to thoroughly test the material on these plants, and cannot give any reliable information just now. We are carrying out tests, but it is suggested that farmers might also conduct small trials themselves. We shall always be pleased to hear of results obtained by farmers.

In the last article the writer recommended the spraying of ragwort from early October onwards. Now, with the extra two or three months' experience since the article was written, there can be no hesitation in advising farmers to start spraying so soon as the second growth appears in the autumn and to go right on throughout the winter so long as the plants are appearing. This has the great advantage that the spraying may be done when the grass is short and the ragwort easily seen, and when more time is available for this class of work. Solutions of 2 to 2½ per cent. are quite strong enough for winter work on ragwort. As already advised, a fine day should be chosen for the spraying.

In the previous notes it was pointed out that both sodium and calcium chlorate had been tested by the Fields Division and that both appeared efficient, but that we considered sodium the better. At the present time there are indications that ample supplies of sodium will be available at about 5d. per pound for drums of 2 cwt., at 6d. to 7d. per pound for smaller parcels, and with special quotations for ½-ton lots.

Representations have been made to the Department of Agriculture that we should import the chlorates and sell to farmers at cost price, but it has been decided that so long as merchants import sufficient and sell at a reasonable profit over cost the Department will not interfere. Should any attempt be made to impose an undue profit the Department certainly would reconsider the position. From the great interest merchants are showing in the matter this is not likely to happen, however.

Considerable discussion has taken place on the merits of calcium chlorate as against sodium chlorate, particularly in regard to the fire risk. The advantages of sodium chlorate are that it appears to do better work, is cheaper, better to handle, and ample supplies of it are available. Supplies of calcium chlorate, on the other hand, are not so plentiful, and, as already mentioned, it is at present more costly; also, as it readily absorbs moisture it is not so easy to handle. It does not, however, present the same risk from fire. We have just ...ed a further half-ton of calcium chlorate, and its advantages and ...antages will be thoroughly tested this year.

...e does not appear to be much risk with the dry sodium chlorate ...s it is not mixed with any other dry material, such as dry

earth; but if mixed with the latter or similar material it is supposed to burn readily if it comes in contact with fire. The greatest danger appears to be when clothes become saturated with the liquid spraying material and are allowed to get dry. They then burn rapidly if allowed to come in contact with fire. Persons using sodium chlorate as a spray should endeavour to keep their clothes dry, and if by chance the clothes get wet they should be rinsed with water—hot or cold—before drying. As a precaution, users are advised to wear oilskin leggings or gum boots when working with this spray. One of the Fields Division officers wore gum boots for several months when spraying with this material, and so far as can be seen it has not had any detrimental effect on the boots or his clothing.

Dealing with Blackberry.

At a recent field-day gathering in Taranaki the writer mentioned in reply to a question that there were indications that sodium chlorate would kill blackberry, but that we would not be in a position to give definite advice as to the proportion of kills or best method of application until experiments which were under way had been going long enough to give conclusive results. This was miscontrued by some of the newspapers into statements that we were definitely recommending its use to kill blackberry. The position is that our trials show with blackberry, sprayed last December when in full bloom, a large percentage of the plants killed, but some are still growing and will require further attention. This is in keeping with some of the experiments in Victoria, where the greater bulk of the blackberry was killed with a 15-per-cent. solution of sodium chlorate when sprayed in the summer, and a second spraying in the autumn cleaning up the remainder. There are also indications that applying the dry crystals round the roots of the blackberry might prove effective. However, as already indicated, we shall have reliable information on the subject later on. In the meantime farmers may test the matter for themselves.

Spraying Apparatus.

A knapsack sprayer will be found the most serviceable for general use, and it should always be fitted with a trigger spray, which gives the person using it good control and prevents waste of material. The spray nozzle should also be fine so as to nicely wet the plants without using a great deal of material. A very good type of sprayer is now being made at Christchurch, and is retailed by dealers at £4 2s. 6d. Where only small quantities of weeds are to be sprayed a garden syringe may be used. Again, where only very scattered plants are to be treated it will probably be best to carry a small quantity of the crystals, and after bruising the plant with the heel, put two or three crystals on its crown.

It may be mentioned here that the Live-stock Division of the Department, which carries out the inspection of noxious weeds under the Act, is equipping its field officers with spray pumps and material to give small demonstrations in their districts in order to encourage farmers to adopt this means of weed control. All who are interest would do well to get in touch with the Stock Inspector for district.

FACTORS INFLUENCING THE ABORTION AND STERILITY RATES IN DAIRY HERDS.

BREEDING DATA FROM NORTH TARANAKI DISTRICT.

W. MAURICE WEBSTER, B.Sc., M.R.C.V.S., Veterinarian, Live-stock Division, New Plymouth.

IN order to form a comprehensive and reasonably accurate estimate of the prevalence of abortion and sterility in North Taranaki dairy herds, and also to ascertain to what extent the breeding-efficiency of a herd is influenced by the methods of management and maintenance adopted, practically every dairy-farmer in this district was circularized early in September, 1929.

Information was sought on the following points by means of a questionnaire to the following effect :—

(1) Acreage of farm.
(2) Number of dairy cows in herd
(3) Whether (*a*) cows were hand-served—that is, bull kept separate and cows taken to him as required, or (*b*) bull was allowed to run with the herd.
(4) Date on which breeding operations commenced
(5) (In case of 3*a*). Number of cows holding to first service
(6) (In case of 3*b*). Number of cows calving to full time or before 31st August, 1929.
(7) Number of cows which failed to become pregnant
(8) Number of "slips" or abortions during the winter.
(9) Method of herd-maintenance—(*a*) solely by home-reared heifers, (*b*) by outside purchases
(10) Whether the cows were given to chewing bones, &c.

One thousand four hundred and eighty-nine copies of this questionnaire were posted and 644 replies were received; seventy-one of the latter were discarded, mainly owing to incomplete or approximate figures being entered, and the remainder have been systematically tabulated.

Twenty-three herds were picked out in which the owners reported considerable breeding difficulty. The returns showed only from 30 per cent. down to nil of the cows to have calved on or before 31st August and/or to have held to the first service. Sterility apparently existed in epidemic form in these herds, which will be dealt with later as a separate group.

The remaining 550 returns were regarded as normal, with 50 per cent. and upwards of the cows calving on or before 31st August.

The returns were tabulated to contrast the following points :—

(1) Herd-management—Hand service as opposed to allowing the bull a free run with the herd.

(2) Herd-maintenance—Home-reared heifers as opposed to outside purchases of cows and/or heifers.

In a number of returns it was stated that the bull was running with the herd, but full service records had been kept as for hand service. Such returns, however, were not classified as hand-served. Similarly in regard to maintenance, where it was stated that the herd was

chiefly maintained by home-reared heifers and only occasionally by outside purchases, it was nevertheless classified under the latter heading.

Table 1.

Column 1.	2.	3.	4.	5.	6.	7.	8.
Group.	Maintenance.	Number of Herds.	Number of Cows.	Average Number of Cows per Herd	Number of Cows calving on or before 31st August and as Percentage of Total	Number of Slips or Abortions and as Percentage of Total.	Number of Empty Cows and as Percentage of Total.
Group I— Hand-served ..	Home-reared heifers	141	5,555	39·4	4,108=73·9 per cent.	234=4·2 per cent.	215=3·9 per cent
	Outside purchases	97	4,036	41·6	2,776=68·7 per cent.	260=6·4 per cent.	229=5·7 per cent.
Group II— Bull running with herd	Home-reared heifers	180	7,724	42·9	5,196=67·2 per cent.	360=4·7 per cent	213=2·7 per cent.
	Outside purchases	132	6,488	49·1	4,013=61·8 per cent	368=5·7 per cent.	288=4·4 per cent.
Totals .	.	550	23,803	43·3	16,093=67·6 per cent.	1,222=5·13 per cent.	945=3·97 per cent.

General Discussion.

Table 1 shows the average results obtained by the four alternative combinations of herd management and maintenance. It should be stated here that in the "hand service" group the figures show as "calved on or before 31st August" were actually the numbers shown in the returns as "holding to first service." The reason for this was that in the wording of the questionnaire the former question was unfortunately made optional in the case of hand-served herds from which exact breeding records were available. Both questions were, however, answered in respect of eighty-five herds, in which 2,302 cows were returned as "held to first service" and 2,291 as "calved on or before 31st August." As a rule, where breeding commenced towards the end of October these returns showed more cows "held to first service" than "calved to 31st August," whereas when it was commenced early in October the reverse was the case. In the aggregate, however, these discrepancies almost exactly balanced—a difference of eleven in 2,302 records representing only 0·4 per cent error. In view of this it may be safely assumed that the total for the whole group which "held to first service" was to all intents identical with the number "calved on or before 31st August."

Apart from this, the variations in the percentages in each column may be considered wholly significant, the probable margin of error in so large a cow population being extremely small.

The results indicate quite definitely that hand service increases the average breeding-efficiency of a herd, taking the numbers calving on or before 31st August as a basis. Group I (hand-served) gives an average of 71·8 per cent. as compared with 64·8 per cent. for Group II, a difference of 7 per cent. in favour of hand service.

Breeding-efficiency is also influenced by the method of herd-maintenance. In both groups there is a definite decrease in the breeding-efficiency of the subgroup shown as maintained by outside purchases compared with that maintained by home-reared heifers. In addition to this general decrease in breeding-efficiency in the "outside purchase" subgroups, there is an increase in the number of both "slips or abortions" and of "empty cows" to the extent of roughly 2 per cent. The relative figures for "slips or abortions" in the subdivisions of each group show little or no significant variation, but those for "empty cows," although the relative variation between the subdivisions of either group is approximately the same, are definitely less in Group II than in Group I. The explanation of this probably lies in the fact that breeding operations are carried on to a later date in those herds in which the bull is running. In quite a number of instances the date at which breeding ceased for the season was given in the space left for "Remarks" in the questionnaire. These replies showed that it was often the practice to give up attempts to breed about the end of January and to carry through any cows empty at that date in hand-served herds, whereas the bull was frequently allowed to run with the herd until the end of February or later. This would undoubtedly result in a few cows holding to service very late in the season and so lower the percentage for this group.

The Breeding Season.

The date on which breeding operations commenced for the season varied to some extent with the district. Coastal districts had a tendency to begin early in October, while colder and more backward inland districts, as a rule, were two or three weeks later.

Replies were not furnished in every instance regarding this question, but in 334 returns a definite date was given, the results being as follows :—

September 24–30 ..	.. 24 herds.	October 15–21 ..	.. 101 herds.
October 1–7 ..	.. 44 ,,	October 21–28 ..	.. 59 ,,
October 8–14 ..	.. 53 ,,	October 29 to November 4	53 ,,

In a few instances the date was later still, but such returns were included in the group of seventy-one discards mentioned earlier and not used in the general analysis.

These figures show that there is a very definite peak in the third week in October. Cows bred from this date will calve from 1st August onwards.

In the case of hand-served herds it has already been shown that "holding to first service" and "calving on or before 31st August" were in the aggregate practically synonymous terms, and it is a safe assumption that this statement holds good over the whole series of returns, since the great majority of cows which fail to hold to their first service must, obviously, calve subsequently to 31st August. It follows, therefore, that any decrease in the percentage of cows calving on or before 31st August represents an increasing percentage which failed to hold to the first service.

An analysis of some 700 individual breeding records has shown that, while a few cows return to the bull at a shorter interval than the

normal three-weekly period a considerable number exceed this time, and the average interval over the whole series was twenty-five days.

As a concrete example of the significance of the figures already quoted, the breeding-efficiency (number of cows holding to first service) of a herd of one hundred cows on the hand service and home-reared heifers system is, according to Table 1, column 6, 73·9 per cent., while a similar herd run with the bull and maintained by outside purchases shows only 61·8 per cent. efficiency, a difference of 12·1 per cent., or a loss of the production of twelve cows for a period of twenty-five days—a considerable item.

Factors influencing System of Herd Management and Maintenance.

Herd management and maintenance are both influenced to some extent by the size of the herd. Table 2 shows that 238 hand-served herds average 40·3 cows per herd, while 312 herds with which the bull runs average 45·5 cows per herd.

Table 2

——	Herds.	Cows.	Cows per Herd.	Acres per Farm.	Acres per Cow.
Group I ..	238	9,591	40·3	117·7	2·92
Group II ..	312	14,212	45·5	133·3	2·93

Reference to Table 1, column 5, shows that of the 238 hand-served herds 141 are maintained solely by home-reared heifers and average 39·4 cows per herd, while 97 maintained by outside purchases average 41·6. The 312 herds with which the bull runs show 180 maintained by home-reared heifers and averaging 42·9 cows per head, while the remaining 132 maintained by outside purchases average 49·1 cows per herd.

Contrary to expectations, however, closer subdivision, leading to a better utilization of the land, is apparently not a factor influencing the system of herd-management adopted. Table 2 shows that the average size of the farms comprising Group I (hand-service) is 117·7 acres, while that of Group II is 133·3 acres. However, the area required to support each cow in Group I is 2·92, and in Group II 2·93 acres—practically a constant. The increased acreage per farm in Group II (15·6 acres) compared with Group I is exactly accounted for by the increased average size of the herd in the former group (5·2 cows).

The Significance of Bone-chewing.

The importance of adequate mineral supplies in the diet of stock is universally admitted at the present time. The mineral requirements of various classes of stock vary to some extent. Those of the modern dairy cow are particularly high, especially as regards phosphorus. This is becoming more and more universally appreciated, as evidenced by the annually increasing application of phosphatic manure to dairy pastures. The significance of bone-chewing lies in the fact that about 84 per cent. of the mineral matter of bone consists of calcium phosphate, and when cattle are grazing on minerally deficient pasture they

instinctively endeavour to satisfy their craving for further phosphorus by eagerly chewing any bone which they can find.

It is a well-known scientific fact that an extreme phosphate deficiency may reduce the breeding efficiency by bringing about a total inhibition of any sexual desire (heat periods). Such an extreme deficiency on dairy pasture is rare and was not reported in any instance.

However, bone-chewing is a safe indication of some degree of phosphatic deficiency, and the last query in the questionnaire was designed to ascertain to what extent a slight deficiency influenced the breeding efficiency.

Table 3

—	Reported Bone-chewing	Bone-chewing non-existent.
Number of herds	72*	478
Number of cows	2,986	20,817
Number of cows calving on or before 31st August	1,903 = 63·7 per cent.	14,190 = 68·2 per cent.
Number of slips or abortions	179 = 5·96 per cent	1,043 = 5·01 per cent.
Number of empty cows	124 = 4·15 per cent.	821 = 3.94 per cent.

*Hand-served and home-reared heifers, 16 herds, hand-served and outside purchases, 13 herds bull running and home-reared heifers, 21 herds, bull running and outside purchases, 19 herds.

Table 3 shows that seventy-two herds which reported bone-chewing gave a decrease of 4·5 per cent. in their breeding-efficiency (number calving normally on or before 31st August) compared with the remainder of the returns which reported no bone-chewing. The figures for "abortions" and "empty cows" are both higher, although only slightly. The differences are probably wholly significant, as the numbers of herds under each of the alternative methods of management and maintenance (as shown in the footnote to Table 3) are proportionally almost identical with those of the complete series (see Table 1, column 3).

The increases of "abortions" and "empties," though slight, are interesting in view of the fact that the United States Department of Agriculture has reported an increase of abortion and sterility on mineral-deficient pasture.

In addition to the seventy-two herds whose owners reported bone-chewing, a further forty-eight farmers stated under "Remarks" that this habit was formerly in evidence in their herds, but had ceased of recent years as a result of regular phosphatic top-dressing.

Apparent Epidemic Sterility.

As stated earlier, returns from twenty-three herds revealed evidence of the existence of what appeared to be an epidemic form of sterility. These herds totalled 1,289 cows, with 226 or 17·5 per cent. calving on or before 31st August, 72 or 5·6 per cent. "slips or abortions," and 129 or 10 per cent. "empty cows." A discussion of the specific cause of such outbreaks of sterility is outside the scope of the present article. It will suffice to state that it appears to be a definitely infectious disease and not directly related to contagious abortion, since the percentages of abortions (5·6 per cent.) is similar to the normal average (5·1 per cent.).

Herd-management does not appear to affect the incidence of such outbreaks, since approximately equal numbers were "hand served"

and "run with the bull." Herd-maintenance, on the other hand, appears decidedly significant. Whereas in the 550 herds considered "normal" 321 were maintained by home-reared heifers and 229 by outside purchases—a ratio of 1 : 0·7—in this group the numbers are 8 and 15 respectively, a ratio of 1 : 1·87. Purchases in the open market would therefore appear to greatly increase the risk of introducing an epidemic form of sterility into a herd.

CONCLUSIONS.

(1) In North Taranaki the proportions of cows calving on or before 31st August, aborting, or failing to become pregnant are approximately 68 per cent., 5 per cent., and 4 per cent. respectively, calculated on returns totalling 23,803 cows.

(2) Hand service combined with herd-maintenance by means of home-reared heifers results in the highest average breeding-efficiency, while the practice of allowing the bull to run with the herd coupled with maintenance by means of saleyard purchases gives the worst results.

(3) Irrespective of the method of herd-management, maintenance by outside purchase results in decreased breeding-efficiency, together with increased numbers of abortions and empty cows.

(4) The methods of herd management and maintenance adopted are influenced by the size of the herd, the smaller the herd the greater the tendency to hand service and maintenance by home-reared stock, and *vice versa*.

(5) The size of the farm is not a factor influencing the system of management and maintenance.

(6) Bone-chewing is a sign of mineral deficiency, and is reflected in a decreased general breeding-efficiency, and possibly in increased abortion and empty cow rates.

(7) Epidemic sterility apparently exists in about 3·5 per cent. of herds, and its incidence seems to be markedly influenced by the system of herd-maintenance, being nearly twice as prevalent in herds kept up by outside purchases (see also No. 3 above).

(8) Apparent epidemic sterility is not directly connected with contagious abortion, since the abortion rate in affected herds is similar to that for normals.

Siberian Cheese and Butter on London Market.—In a recent report Mr. W. Wright, Inspector of New Zealand Dairy-produce, London, remarks: "There has been a certain amount of cheese arriving in London recently from Siberia. When compared with pre-war days the cheese shows a marked improvement in make, but the flavours are very unclean—in fact, 'vile' would not be too strong a term to use. The shippers, however, take great care, not only with the cheese, but also with the butter exported. For instance, the individual cheeses are packed in crates, but first of all wrapped up in paper and then packed in wood shavings. In the case of butter, the quality of which is variable (but which does also show a certain amount of improvement in quality), the individual casks are wrapped up in a woven mat, after the style of some mats that are woven with New Zealand flax. On arrival of the shipment at Hay's Wharf, and before going into cold store, these wrappers are removed and the casks are then found to be in quite a clean condition, free from soiling of any kind, which makes the packages look very attractive to the trade."

MINERAL CONTENT OF PASTURES RESEARCH.

SOME NOTES ON THE WORK IN 1929-30.

B. C. ASTON, Chief Chemist, Department of Agriculture.

IN order to keep in view the aim of the Empire Marketing Board in granting a considerable sum of money annually for work on the mineral content of pastures in New Zealand for a term of years, it is desirable briefly to define the objective. Instructions remitted to the writer, as director of the grant made to the New Zealand Government, in February, 1928, explicitly stated that the money was granted by the Empire Marketing Board to test the application of the work of the Rowett Research Institute to New Zealand pasture. There was great need for testing, by feeding experiments or by grass-analysis, the value of mineral supplements in lime, phosphoric acid, and iodine deficient areas If such deficiencies do occur in New Zealand, it is obvious that mineral supplement feeding will at once raise production. It will decrease mortality and improve wool. It was understood by the Imperial authorities that there were in New Zealand areas exhibiting evidence of mineral deficiency in the pasture, and therefore that a few experiments would demonstrate the importance of mineral supplements.

It will be noted that two kinds of evidence mentioned as necessary in determining the occurrence of deficiency of minerals are (1) that derived from feeding experiments, and (2) that derived from grass-analysis. There is no mention of blood-analysis or analysis of other portions of the animal. As the Rowett Institute is well supplied with physiologists and physiological chemists, blood-analysis would no doubt have been mentioned could any reliance be placed upon it as a method of detecting deficiencies in food.

It is evident that, without experiments on animals in the field, results of mere analyses are unconvincing. During the past year, therefore, endeavour has been made to push the animal experimental side of the investigation. Experiments with various licks, pellets, and other substances have been instituted with both sheep and cattle. Continued great and undoubted success has attended the use of the double citrate of iron and ammonium, so that the complete control of bush sickness in cattle at an early date may be confidently anticipated. The effective use of this compound with cattle has been recognized for several years by the Department of Agriculture and some settlers, but the idea of giving an additional food element is a novel one and takes years to establish as a practice.

A pleasing development of recent growth is the endeavour to use the remedy found so successful with cattle, to accomplish the continuous grazing and development of sheep on bush-sick lands. An experiment, begun in July, 1928, at Mamaku Demonstration Farm with a small flock of wethers was entirely successful in bringing the sheep back to health when they had started (in January, 1929) to become bush sick on unimproved paddocks heavily top-dressed with phosphates, and they were kept in good health for a year subsequently by the use of

iron pellets. Finally the wethers were sold fat. The difficulties in connection with the automatic administration of the extra food iron to sheep are, the writer is convinced, not insuperable, although difficulties have been encountered in the past year and losses sustained. Such are unavoidable in any original work where it is sought to impose an entirely new treatment of stock on the farmers.

In connection with this phase of the use of iron remedies, a recent report received states: "It is interesting to note that the five lambs and six ewes mentioned as having survived the hardships necessary to induce them to take the pellets are now in splendid condition and doing exceedingly well. These lambs are the first ever reared to the hogget stage on this farm. The future prospects of rearing one's own lambs to the breeding-ewe stage, which, incidentally, is the ideal aimed at in these experiments, is indeed bright, judging from the results of these few sheep under trial only three brief months."

PASTURE-ANALYSIS.

At the beginning of the working-year a scheme of work was laid down which would indicate roughly the effect of seasonal changes on the composition of typical pastures. The initial demand that the sampling of the pastures was a highly important work which required just as much skill lavished on it as on the analysis having been conceded, Mr. R. E. R. Grimmett, who has always been utilized as the officer in charge of the country work, was charged with the duty of supervising the collection of the pasture and soil samples in all cases except the Te Kuiti district.

The areas set down for intensive study were—

(1) The Te Kuiti district.
(2) The Wairarapa district.
(3) The Taranaki district.
(4) The Rotorua district.
(5) The Waikato district.
(6) The Poverty Bay back areas.
(7) Otago Central and Southland areas.

Various troubles in stock occurring in these districts led to their being chosen for work in this investigation, among which were—

(1) Temporary sterility }
(2) Eclampsia } (in cows).
(3) Waihi disease }
(4) Bush sickness or similar trouble (in cattle and sheep).
(5) Dopiness, or Mairoa malnutrition (in sheep).
(6) Iodine deficiency (in sheep).
(7) Pulpy kidney (in lambs).

Under the close supervision of the local or other veterinary officer of the Department of Agriculture, in all areas except Te Kuiti, farms were selected from which during the year under review periodic samples could be collected. It was not anticipated that work for one year would establish seasonal differences. The seasons in the North Island are notoriously fickle, the temperature and precipitation being extremely variable for the same season in different years. It was impressed on the samplers that they should exercise the greatest care in selecting the samples, and the Department obtained two assistants who were peculiarly fitted for this work.

SOIL-ANALYSIS.

In past years the examination of the country in the Rotorua district has yielded evidence of the greatest value in the mechanical analysis of the soil. It was found possible to classify the country more easily on the basis of soil-texture rather than on either geological or chemical considerations, and the texture (which can be expressed arithmetically) will be the guiding principle in determining the liability of bush sickness to occur on different lands. Whether this method will be found equally useful with malnutrition diseases other than bush sickness remains to be determined.

Te Kuiti District

The work in this area consisted chiefly of experiments in the field on animals, and the collection of samples for analysis. These experiments were under the control of Mr. C. M. Wright, Country Analyst. In January last Mr. Wright was promoted to the Native Department, and this rather upset the continuity of the field-work, as the results of a number of field experiments laid down and controlled entirely by him had yet to be adequately reported upon.*

The laboratory-work in this district has consisted largely in the analysis of soils and some pastures. During the last few months the taking of samples from Mairoa, which for various reasons offered difficulty to the samplers, has greatly been improved. Regular and good samples have now been received, and are being analysed as quickly as circumstances permit.

"MAIROA DOPINESS."

The investigation of any deficiency disease in domestic stock is best studied in three different directions with the object of ascertaining how (1) the soil, (2) the pasture, and (3) the animal differ from the normal; and each of these three factors in farming should be studied *separately* to determine how far each departs from the normal.

In the case of air-borne volcanic showers of *fine* material which form the typical soils of the Mairoa district and many other areas, an initial study of the mechanical and chemical composition of the soil brings out certain abnormalities wherein the soil differs from that of average hillside upland sheep-pastures of the North Island. These are (1) the very high "lime-requirement" by the Hutchison-McLellan method—roughly about 10 tons per acre; (2) the very high organic matter content—20 to 30 per cent; and (3) the exceptionally porous nature.

The soils belong to the class called "loams," which are universally recognized as fertile soils; hence it is probable that normal returns may again be expected under suitable treatment. In the three above particulars the Mairoa soils and probably all similar fine-grained volcanic soils with a similar history are an exception to the ordinary poor upland sheep-runs, and it may be in the study of these divergencies that a clue will be found for the failure of the herbage to sustain normal growth in the animals thereon depastured. That the soil exhibits in common with other soils put to a like purpose similar deficiency (*e.g.*, phosphoric acid) does not help much, seeing that similar deficiency occurs on all poor hilly country where disease does not develop.

* This report has not yet (June) been received by the writer.

There can be no doubt of the excessively high lime-requirement. In addition to the samples investigated by the officers of this Laboratory, Mr. J. K. Dixon, M.Sc., a research student, has spent several months at Te Kuiti carefully examining the lime status of the soils of the district, including pH value, replaceable lime and lime-requirement figures, and fully confirmed the immediate need for lime in the following unmistakable pronouncement:—

> The application of the above methods to the district of which Mairoa is the centre shows that the country needs lime badly, and if the same figures were obtained for Southland soils one would not hesitate to recommend the application of 3 to 4 tons of limestone within the next few years. In view of the heavy leaching that goes on in the 100 in. rainfall district, it will be more economical to apply the lime in small quantities after a heavy initial dressing, rather than heavy top-dressings at long intervals.
>
> The point that must be stressed is that although the lime required may vary from the typical light loam to the heavy mudstone-derived soil, yet wherever there is this light ash-derived browny sandy loam as a topsoil, either pure or mixed with the underlying formation, there is a pressing need for the immediate application of lime.

The writer, it will be remembered, has always emphasized the extreme need of lime for these soils (this *Journal* for September, 1928, p. 145) and the effect of leaching.*

* It is hardly likely that one of the elements leached out should be phosphorus. The Rotorua coarse pumice lands are subject to heavy leaching by a rainfall of 70 in. Cattle-farming is the type of grazing practised there, but no Waihi disease occurs on such pumice types, even on unmanured land. Such would undoubtedly occur were phosphoric acid leached out in any quantity. On the Mairoa loams, where dairy-farms are common, there is no history of Waihi disease occurring. This trouble is undoubtedly due to lack of phosporus in the pasture.

Regarding the high organic-matter content, it is difficult to assess the effect, but such soils are usually responsive to lime dressings.

The porous nature of the soil, making this subject to excessive leaching, is further evidence that lime is highly necessary, seeing that lime is a mineral substance lost by leaching from soils in very large amounts. Experience on many different types of soil in America, England, Scotland, India, and elsewhere gives unanimous evidence that phosphates are leached out only in very small quantity. In experiments at Rotorua with a very coarse pumice soil treated with superphosphate no phosphate could be detected in the drainage effluent from a lysimeter. Joachim ("Peradenya Drainage and Leaching Trials," *Tropical Agriculturist*, Vol. 73, No. 5, 1929, p. 271) states that "no phosphoric acid appears to be lost in the drainage waters of the Ceylon soils." Hendrick (*Trans. Highland and Agricultural Society*, Vol. 33, 1921, p. 76), "An Account of the Craibstone Drain Gauges") states: "Yet so well is the phosphate held by the soil that practically none of it is washed away in the drainage." Dyer found that no less than 83 per cent. of the phosphoric acid which six of the plots at Rothamsted should from calculation possess after fifty years' manuring was still present in the top 9 in. of the soil, whereas the subsoils from 9 in. to 18 in. and 18 in. to 27 in. showed no accumulation of phosphates (Hall, "The Soil," p. 221). Russell stresses the fact that, of all bases, calcium is the one most easily lost ("Soil Conditions and Plant Growth,"

1927). He states that P. W. Robinson considers calcium starvation the chief factor in North Wales soils subject to heavy rainfall

It may be taken, therefore, that not only is there great deficiency of lime in the Mairoa soils, but that this deficiency is progressing both at Mairoa and on other soils more recently cleared and grassed; so that the experience at Mairoa may be expected to occur elsewhere in course of time. It must always be remembered that the initial history of Mairoa was highly favourable to the use of that type of country for sheep; that after some years of stocking the country did not improve as does the typical bush-sick pumice country, but after a time progressive deterioration set in and the utilization as sheep country became unprofitable. Something evidently was comparatively rapidly leached out of the soil, and that this something was lime there is much circumstantial evidence to prove. It may therefore be taken as proved that the crying need of this area in order to make the soil more normal is lime carbonate.

The analysis of the pasture provides the second class of criteria which must be examined in investigating deficiency diseases, and this is a more difficult direction to explore, owing to the fact that one is dealing entirely with living matter which is changing in chemical composition all the time with the climate and season, with the stage of growth, and with the botanical composition. Nevertheless, the analyses of the Mairoa pastures do show an abnormally low calcium content at all seasons of the year, and when these pastures are top-dressed with calcium carbonate they do, if the samples are properly taken, show an appreciable increase in the lime content The entire absence of leguminous constituents in the untreated pastures upon which the malnutrition develops is further evidence of calcium deficiency, since legumes are the characteristic lime-winning plants in a pasture normally containing from two to three times as much calcium as the grasses contain even on unmanured land.

Finally, the composition of the animal may be studied, or, what is more to the point, the physiological symptoms. This is a very special department, and the technique is as yet poorly developed and very difficult to carry out. That this is realized by the authorities is shown by the importance attributed to the analysis of the pastures. Were it possible to determine from an analysis of blood, for instance, from what particular deficiency the animal is suffering, and any reliance could be placed on the result, the lengthy and laborious gathering and analyses of pasture samples could be largely discontinued

The proof of all the conclusions reached in the laboratory is, of course, the actual results on animals on a field test. The results of these will form the basis of a separate report, but an outstanding case may briefly be narrated.

A field experiment was carried out on a bleak hillside of 20 acres, 1,000 ft. above sea-level, where the pasture was brown-top, fog, and danthonia growing among the stumps of the old burn, the land not having been ploughed or top-dressed at any time An application of 40 tons of very roughly ground limestone was made on the 20 acres in January, 1928. The history of this paddock of recent years has been that of high mortality experienced from malnutrition in sheep, and it was considered that parasites were not

responsible. Forty culled hoggets from a near-by farm, but one more sheltered and with a better pasture than the experimental paddock, were transferred to it in February, 1928. The hoggets did well. Unfortunately, dogs visited the paddock in March, 1929, and killed, injured, or drove into the creek a number of sheep. Nevertheless, when the experiment was concluded in March, 1930, thirty-two sheep were found on the limed paddock, and were seen by the two highest veterinary authorities in the Dominion, who reported them looking healthy and in very good condition. The owner of the sheep was so well satisfied with the results of lime in curing the malnutrition that he ordered 75 tons. Gypsum (land plaster or sulphate of lime) apparently has the same effect in curing the malnutrition.

The writer has from the first always contended and has publicly stated that the Mairoa type of country cannot be farmed without phosphates, but he entirely agrees with Mr. C. M. Wright that "lime is the limiting factor" in bringing the calcium-deficient area back to productive capacity (Annual Report of Department of Scientific and Industrial Research for 1928–29, pp. 23–26). Following excellent precedents, the land may be described as calcium-starved, and the trouble as "calcium starvation."

Some proved method of curing the malnutrition must be discovered before attempting to increase production by phosphate dressings A mixture of lime carbonate and superphosphate known as the "5 : 2 mixture" (5 cwt. carbonate of lime to 2 cwt. of superphosphate per acre) has given great promise of being curative as well as of increasing the carrying-capacity. Full details of the animal experiments will doubtless be available for discussion later when the report on the field experiments is received.

Rotorua and Adjoining Counties.

The experiments in the coarse pumice area involved the usual treatment of animals with pellet, lick, and drench, the collection of pasture samples, the treatment of the soil by manuring and by top-dressing with fertilizers, and the collection and analysing of drainage-water. Mr. C. R. Taylor, a Country Analyst's skilled assistant, has been stationed at Rotorua in order to further these experiments. It is satisfactory to note that no evidence can be obtained of any leaching of phosphates from the soil when they are applied as superphosphate in the area of coarse soil and heavy rainfall (60 in. to 70 in.). Mr. Taylor also supervised experiments with various chemical compounds (including sodium chlorate) and mixtures on the eradication of ragwort by chemical means, and these provide evidence that ragwort, which is considered locally a great danger and cumulative with bush sickness in preventing the settlement of the pumice lands, need no longer be feared.

The writer of these notes has previously remarked on the fact that soils formed from volcanic air-borne showers of material when coarse in texture give rise to malnutrition or deficiency diseases in ruminants, whereas adjacent or near-by sedimentary soils, even though principally derived from similar materials as the air-borne showers, are free from such diseases. There has been the inevitable tendency to confuse

similar deficiency diseases, and the hypothesis has been advanced that the "Mairoa dopiness" in sheep is the same as "bush sickness," in spite of veterinary advice to the contrary. The exact definition of these two diseases is, of course, work for an animal pathologist, but it may be remarked that a typical bush-sick animal, even at death, has healthy well-developed bones, whereas in Mairoa dopiness animals have light bones. It does not seem possible that a bush-sick animal should be suffering from a deficiency of phosphates and lime when at all stages of its growth it is able to develop such good bones as do the animals on typical bush-sick country. Further, there is the experience acquired at the Mamaku Demonstration Farm and elsewhere by several direct experiments that top-dressing the pasture with phosphates or with lime does not eliminate bush sickness. At Mairoa, on the contrary, there is gradually accumulating evidence that phosphates and lime, and even lime or gypsum alone, are curative when applied to the soil. Veterinary authorities assert, moreover, that the symptoms of these diseases are sufficiently distinct for them to be separated.

BUSH SICKNESS.

The year has witnessed many suggestions from various experts as to the cause of the progressive anæmia in ruminants known as "bush sickness" or iron-starvation. The new hypotheses (for they can hardly be dignified by the name of theories, as they are put forward without any evidence to support them) are: (1) That bush sickness is due to deficiency of available calcium in the soil; (2) that it is due to deficiency of available phosphoric acid in the soil, (3) that it is due to both calcium and phosphoric acid being deficient; (4) that it is due to a poisonous mineral element in the soil; (5) that it is due to a poisonous organic compound in the pasture.

Nos. (1), (2), and (3) are disposed of from the fact that there is ample lime and phosphoric acid in much of the pastures upon which stock become bush sick, so that no amount of top-dressing with phosphates will cure the trouble in a season or so, although top-dressing undoubtedly enables the stock to be kept longer in health on the top-dressed compared with the non-treated paddocks. Neither does administration of phosphates to an animal enable it to recover when affected with sickness, nor prevent it from being sick. That the bones of an animal dying of bush sickness are always normal in composition and texture is also significant, the bones being the repository or bank of phosphates and lime in the animal.

Those seeking a poisonous element have the difficult task of finding one in such diverse soil-formers as the pumice lands of Rotorua, the dune sands of New Zealand generally, the calcareous dune sands of Tasmania (King Island), the granitic gravel wash of Nelson, the volcanic ash of Mount Kenya (Africa), and the Cheviot Hills of Scotland on a coarse sandy silt—on all of which the bush-sickness condition occurs.

Those seeking poisonous organic compounds must search in such diverse fodder-plants as grasses on the one hand and clovers on the other. It is hardly possible that two such widely separated botanical families as the Gramineæ and the Leguminosæ could elaborate within their tissues the same organic poison.

One feels certain of the fact that these soils, which are undoubtedly bush sick, and which continue to be so for a number of years after they have been cultivated and top-dressed or laid down in pasture, are always found to be coarse-textured soils. That texture will therefore prove to be a deciding factor, and not geological origin, is highly probable. Coarse texture is probably responsible for excessive drainage conditions of soil in spite of seemingly abundant rainfall.

The only economic way of arresting the soil-moisture in its downward path is by ploughing in green manure, and this is probably the method of treatment best calculated to change the state to that of a healthy soil.

It has been suggested that the soil survey of Rotorua County (this *Journal*, 1926 and 1927) should have been made according to geological origin Putting aside the impossibility of doing so in the absence of any existing geological survey at the time the soil survey was required, the evidence afforded by the textural survey was so satisfying in differentiating the land into sick and healthy areas that it would have been foolish to ignore the advantages of texture as a basis of the survey. (See *Journal*, June, 1926, p. 374.)

In referring to the Mamaku deposits as the Rotorua shower, the writer is following Professor A. P. W. Thomas, who originally called the shower by that name and supposed that it had its origin in the vicinity of the Blue and Green Lakes.

That bush sickness has a simple cause, and one for which it is not necessary to postulate poisonous elements in soil or pasture or poisonous organic compounds in the herbage, is the conviction of the writer.

Under certain conditions of rainfall bush sickness will probably occur on all very coarse-grained soils with an almost entire absence of fine particles, no matter what the origin, where *these soils exist in large uninterrupted areas* and are utilized by growing as the main fodder for ruminants what is known in New Zealand as English pasture.

That bush sickness occurs only on soils of coarse texture, even when of the most diverse geological origin, is significant, and discounts the possibility of any poison being present. That the pasture does not affect horses is another reason for dismissing the possibility of any poison being present in the pasture, since it is highly improbable that a poison could exist that would poison ruminants and not horses.

Definite knowledge as to the amount of iron daily required by ruminants as compared with other grazing animals (Herbivoræ) would be the most satisfactory way to a correct understanding of bush sickness. It seems to the writer that it will ultimately be found that ruminants, owing to their much quicker growth, require very much more iron in comparison to the slower-growing non-ruminating horse.

(To be continued.)

National Mark Eggs in Britain.—Under this system, which became effective last year, the marked eggs have but one quality where freshness is concerned and three weight grades. The minimum weights of Special (blue label), Standard (red label), and Pullet or Ducklet Standard (yellow label) are 2¼ oz., 2 oz., and 1¾ oz. in the case of hen-eggs, and 2¾ oz., 2½ oz., and 2¼ oz. in the case of duck-eggs.

ASHBURTON EXPERIMENTAL FARM.

NOTES ON OPERATIONS, SEASON 1929–30.

R. McGILLIVRAY, Fields Superintendent, Christchurch, and J. G. McKAY, Farm Manager, Ashburton.

THE season of 1929–30 was a somewhat trying one in the Ashburton district. The spring was very dry, followed by an unusual amount of rain during December and January. From that period onward dry conditions again prevailed.

The Experimental Farm was again visited by large numbers of farmers and others. Special interest was shown in the potato-certification work, and in the growth of lines of potatoes imported by the Department of Agriculture from Scotland, Ireland, and Canada

WHEAT-SELECTION WORK.

The wheat work carried out was chiefly an extension of the preceding season's operations. Of the varieties under observation, Solid-straw Tuscan, Dreadnought, Velvet Chaff, Solid-straw Velvet, and Major were the most promising of some fifty-seven of the 1928–29 strains. Selections were sown in plots consisting of three rows 50 ft. long, and each trial was replicated eight times.

Increase plots were also sown. The seed in all cases was hot-water treated, and all lines were free from smut. The small plots were harvested by hand and threshed with the small peg-tooth mill. The larger areas were harvested with the binder and threshed with a Settlers' mill. The area of land selected was considered fairly uniform, but the long period of dry weather experienced in the spring showed up marked variations in depth and general condition of soil, and the variations in growth nullified data in connection with the yielding-power of various lines.

A disturbing factor in connection with the raising of pure wheat lines under local conditions is the amount of natural crossing that evidently takes place. Of the different strains of the varieties under trial not one has retained its purity. The location of certain plots indicates that crossing may occur where varieties are quite 10 ft. apart. The condition of several lines has necessitated further selections from all varieties. Some seed of the following varieties is available for distribution: Dreadnought, Velvet Chaff, Solid-straw Velvet, and Major. All seed of Solid-straw Tuscan was sold for milling, as its purity did not reach expectations.

Ear-to-row trials from selected Marquis 10B, Marquis 4, Sensation, and Garnet, and yield trials of these wheats were also conducted in small plots. A buffer of mixed grain was sown round the trial plots as a protection from small birds, but despite this precaution, plus shooting, great damage was done. Garnet was completely stripped, and the Pearl under yield trial was so attacked as to make results valueless.

BARLEY TRIALS.

Four acres were under barley variety trials. Four strains each of the malting varieties, Plumage, Plumage Archer, Archer Spratt,

Goldthorpe Spratt, and Chevallier were sown for observational purposes, and also to obtain sufficient seed for further work and yield trials which will be carried out next season. The seed used was one season removed from the hot-water treatment, and the crops were absolutely free from smut. The long dry period experienced in the spring and early summer resulted in slow growth on the part of the barley, with the result that fathen became a strong competitor, and the amount of seed available for next season's work is not so great as was expected.

POTATO CERTIFICATION.

The number of lines of potatoes grown on the Farm for certification purposes was 323. A more comprehensive method of planting was adopted this season. Each line of one hundred tubers was planted diagonally across the field in short rows of ten tubers. As a yield check every third row was planted with a certified line of Bresee's Prolific. The manurial treatment was 3 cwt. of super per acre applied prior to planting, and a further 1½ cwt. broadcast after completion of planting. No fertilizers were applied in the drill in contact with the seed.

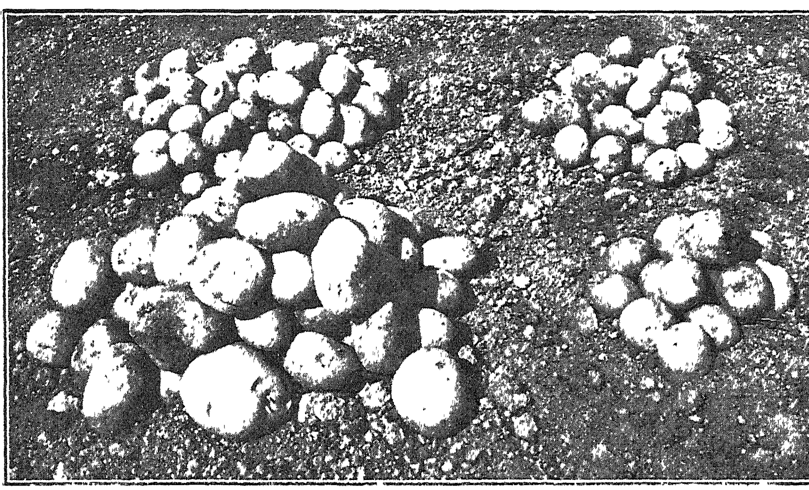


FIG. 1. TWO LINES OF ARRAN CHIEF POTATOES GROWN AT ASHBURTON.
On left, produce of ten shaws fairly free from mosaic disease; on right, produce of ten shaws badly infected with mosaic.

There was a considerable amount of moisture in the soil at time of planting, and growth was rapid, but the lengthy period of dry weather later interfered with development and yields were not as good as was originally expected. The difference between the yields of lines of high cropping-power and those of low cropping-power was very marked, however. Of the 323 lines entered for certification, only eighty-seven passed the second field inspection, and it was probable that some further rejections would take place when the final tuber inspections were carried out.

The principal cause of rejection can be attributed to the presence of virus diseases—in fact, half of all the rejections can be put down to that cause. Some promising lines, however, in so far as cropping-power is concerned had to be rejected owing to a high percentage of rogues in the crop The aim and object of the certification scheme is to eliminate weak, low-producing lines of potatoes, irrespective of variety. The difference in cropping-power of different lines of the same variety when all are grown under similar soil conditions and with the same manurial treatment is quite remarkable. Those who have been in close contact with the trial plots on the Experimental Farm have been deeply impressed by what has been demonstrated regarding differences in cropping-power and in the incidence of various diseases in the same varieties.

Farmers often seek advice as to what variety of potato they should grow. The Ashburton trials have clearly proved the importance of strain rather than of variety. For example, the Dakota variety may be quoted as regards the main crop and Epicure among the early varieties. The yield of table potatoes in the case of Dakota ranged from 11·6 down to 1·7 tons per acre, and that of Epicure from 9·7 down to 0·5 tons.

Following are details of lines entered for certification and grown at the Farm:—

Table 1.

Variety.	Number of Lines.	Total Area entered.	Area rejected in Field.	Area passed in Field
		Acres.	Acres.	Acres.
Dakota	107	476¾	351¼	125½
Aucklander Short-top	62	202	116	86
Arran Chief	35	201¾	198¾	3
Aucklander Tall-top	25	132	66	66
Bresee's Prolific	17	110	32	78
Up-to-date	14	24	22	2
Epicure	13	39½	10½	29
Majestic	9	22	12	10
Iron Duke	6	6	6	..
Endurance	4	8	5	3
Early Regent	3	6	½	5½
Great Scot	3	6½	3	3½
Field Marshal	3	7	2	5
Robin Adair	2	2½	½	2
Sharpe's Express	2	2	2	..
Golden Wonder	2	2	1	1
Brownell's Beauty	2	4	..	4
Other varieties	14	29½	25½	4
Totals	323	1,281½	854	427½

CERTIFIED VERSUS NON-CERTIFIED SEED.

A trial to test the relative cropping-power of lines of certified versus non-certified potatoes of the following varieties was carried out: Aucklander Short-top, Epicure, Up-to-date, Dakota. There were ten replications of each in rows ½ chain in length. Considerable difference was discernible in growth and vigour during the growing-period, and results are as follows:—

Table 2.

Kind of Seed.	Up-to-date.		Dakota.		Auckland Short-top.		Epicure.	
	Table.	Seed.	Table.	Seed.	Table.	Seed.	Table.	Seed.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Certified	4·8	3·6	6·5	2·8	4·5	2·3	1·1	1·6
Non-certified ..	1·7	1·7	3·8	2·8	4·4	2·2	0·4	0·7
Differences in favour of certified	3·1	1 9	2·7	..	0·1	0·1	0·7	0·8

Other Work on Potatoes.

Origin of Seed Trial.—The trial of Ashburton versus Southland-grown Arran Chief potatoes was carried a stage further. The trials were planted with the following lines: (A) Ashburton seed, (B) Ashburton seed once grown in Southland, and (C) Ashburton seed twice grown in Southland. The results of the trials were as follows:—

Table 3

Seed	Table Potatoes.		Seed Potatoes	
	Yield.	Increase over Ashburton.	Yield.	Increase over Ashburton.
	Tons.		Tons.	
A	2·3	..	2·2	..
B	2·9	0·6	2·6	0·4
C	3·3	1·0	2·5	0·3

FIG. 2. GENERAL VIEW OF THE IMPORTED SCOTTISH POTATOES IN FULL GROWTH AT ASHBURTON.

Pure Seed Lines.—These trials were planted with selections of potatoes some of which were imported in 1927–28. An area of approximately 7 acres was utilized for this purpose. Roguing for virus disease was commenced early in December and continued throughout the growing-period Some selections were discarded entirely, while others proved to be of considerable merit both in cropping-power and freedom from disease, and these are being retained for further extensive trials.

Imported Seed.—About 3½ acres was required for the Scottish and Irish seed potatoes imported during the season One hundredweight of fifteen varieties were received from Scotland. and fifteen varieties were later in the season received from Ireland. The Scottish lines made very rapid growth, and a considerable quantity of seed is assured. The Irish lines opened up in anything but a satisfactory condition, and as they were planted late it was doubtful if much seed would be secured.

Several varieties were also received from Canada. These lines only amounted to a few sets of each of the following: Irish Cobbler, Burbank, Green Mountain, Dooley Burbank showed the most vigorous growth and proved the best yielder. These potatoes were very free from virus disease and will be put under trial again next season.

FIELD AND GARDEN PEAS.

About 370 selections from thirty-six varieties of field and garden peas were planted out in September in ¼-chain rows, seeds being spaced 6 in. apart. Germination was exceptionally good in all cases, and although the plants did not make good growth, owing to dry weather, they podded well, and the most promising strains have been retained for further trial.

ONION SELECTIONS.

A quantity of bulbs from nine varieties was planted out in isolated positions on the farm for seed-production purposes. These varieties were grown from seed imported by the Department in 1928, and the purpose of the trial was to endeavour to obtain commercial quantities of seed of varieties possessing long-keeping qualities. The varieties grown were Danvers Yellow Globe, Golden Globe, Southport Yellow Globe. Ebenezer, Sutton's A.L., Australian Brown, Sutton's Improved Reading, Sutton's Globe. A small quantity of seed of each variety has been obtained for future work. but supplies for trial on growers' farms will not be available for some time yet.

LINSEED.

Twenty lines selected from the Bull Moose variety were sown for comparison with a commercial line. A number of varieties from Australia and also various selections made last year were under observation. Considerable variation was present in the Bull Moose selections, and it seems quite possible to evolve a taller-growing strain of this favourite variety. Work will be continued along these lines next season.

Acknowledgments are made to Mr. R. Thomson, Assistant in Agronomy, who throughout the season conducted the plant-selection work organized by Mr. J. W. Hadfield, Agronomist.

SUBDIVISION OF DAIRY-FARMS FOR MODERN GRASS-FARMING.

R. P. CONNELL, M.A., Fields Division, Department of Agriculture, Palmerston North.

THE benefits to be obtained from proper control of pasture growth, especially during the late spring and summer seasons, are rightly receiving ever-increasing attention. This is because efficient utilization of pastures comes only from control of grass growth, more particularly during the periods when the rate of growth is rapid, and it is being more fully realized what a close connection there is between efficient utilization and economic production. This connection was well illustrated in a recent survey of dairy-farms in the Manawatu district, all of very similar soil-type. The survey involved examination of the operations of twenty-five farms The following table summarizes the results obtained on the sixteen most productive farms :—

Production Group.	Butterfat per Acre.	Butterfat per Cow.	Rate of Stocking per 100 Acres	Manure per Acre	Average Size of Farms.
	lb	lb.		Cwt	Acres.
Averaging over 130 lb butterfat per acre—three farms	136	297	47	1·7	82
Averaging 100 to 130 lb butterfat per acre—thirteen farms	109	279	39	1·8	77

These two groups of farms did not differ materially in respect to size, soil, top-dressing, and average production of herds. But they did differ in production per acre to the extent of 25 per cent., and as they were all dependent essentially on grass-farming this difference must be due to variations in the degree of efficiency secured in the utilization of the grass growth. On farms of the type considered the higher efficiency brought an increased annual return of approximately £130 per farm.

Another striking instance of what can be accomplished by efficient pasture-utilization is the production of a farm of 75 acres, all of which was in grass. On this farm in February, 1929, the daily production of butterfat was 87 per cent. of the December daily production. The true significance of this performance becomes clear from the fact that often the February daily production in the same district is from 70 to 75 per cent. of the December production. In this case good pasture-utilization resulted in a lesser seasonal falling-off in the production of stock fed on grass alone than that which often occurs in the production of stock which have the benefit of supplies of special annual forage crops such as soft turnips, maize, millet, &c. This instance is cited not as an indication that producing cows necessarily should be fed on grass alone during February, but as a

partial indication of what can be achieved by efficient pasture-utilization. Farm practice has shown that there is a definite connection between efficiency in pasture-utilization and the number and arrangement of the fields constituting a farm.

On many farms, in the interests of better grassland-utilization, there is need for additions or alterations to the fencing already erected. Adequate subdivision is one of the essentials of efficient grass-management. However, it is well to bear in mind that it is only one of the essential requirements; while adequate fencing does not necessarily mean efficient pasture-utilization, efficient pasture-utilization means adequate fencing It cannot be hoped to practice efficient pasture-utilization on many farms until the fencing provision has been much increased Further, it is fortunate that on many other farms quite substantial improvement in pasture-utilization can be brought about without any great expenditure in fencing, minor additions only being necessary, while in certain other cases greatly improved utilization could be effected by changes in grazing methods, using only the fencing already provided.

From this it will be clear that while subdivision of the farm is important it is not generally of such vital importance as sometimes seems to be thought. The advice occasionally tendered farmers in regard to improved pasture-utilization is of a kind which tends to discourage many from even considering the details of methods of improved utilization—it implies that almost invariably a considerable outlay, which many are not prepared to face, is imperative in respect to such matters as fencing and water-supply Against this the true position is that the present fencing and water-supply arrangements are sufficient in many instances, particularly if supplemented by minor additions, to admit of much improved pasture-utilization even though they do not permit of the attainment of an ideal standard of efficiency.

In brief, in many instances the greatest need is not for heavy expenditure on the part of the farmer, but for a thorough understanding of the principles and practices involved in effective utilization of pasture-growth. Indeed, until it is certain that these principles and practices are understood a heavy expenditure on subdivision may be not only ineffective but actually harmful. This arises from the fact that what is called "extensive" grazing—that which is ordinarily practised on relatively large paddocks—is preferable to a badly managed attempt to graze small paddocks on the intensive or rotational system. The reason for this is that a series of small paddocks which are intermittently spelled and grazed in an inefficient manner will all fairly rapidly during the spring and summer become completely covered with long, mature grass-growth. The result is that no portion of the land being grazed will be producing the desirable short fresh growth. On the other hand, in "extensive" grazing on larger paddocks the stock will allow certain portions of the paddocks to become long and woody and productive of flowering stalks, but at the same time will graze other portions short so that parts at least of the fields will be productive of the desirable fresh leafy well-balanced growth. And these parts will supply feed to meet the milk requirements of the cow and the ewe much better than would a series of small paddocks wholly overrun with long growth in the manner already mentioned.

Another aspect of the subdivision of dairy-farms that is of some importance lies in the fact that it is not always necessary or even

desirable to erect permanent standard fences. Actual field trials have shown that in many instances fences consisting of three barbed wires and four posts to the chain are reasonably effective Such fences are likely to prove all that is necessary, especially in the initial stages when the suitability of the position of new fences may be more or less under trial.

Because the contrary view is at times expressed, it may fittingly be pointed out that quite effective intensive grazing can be secured without subdividing into an exceptionally large number of unusually small paddocks. In support of this the case may be cited of a farmer, holding 75 acres and milking forty-eight cows last season, whose pasture-utilization was outstandingly effective. His farm was subdivided as follows: one paddock of 4 acres, one of 6 acres, six of 7 acres, one of 8 acres, and one of 15 acres, a total of ten paddocks. The pasture-utilization on this farm was markedly better than that on several adjoining similar farms which relatively were better subdivided. This past season (1929–30) the farm has produced 216 lb. of butterfat an acre, while similar farms in the district average about 160 lb. an acre. Such farm experience illustrates the fact that ample subdivision alone will not give effective pasture-utilization. It is to be admitted that on this farm of ten paddocks better utilization could possibly be obtained if further subdivision were carried out For instance, cutting in half of the fields of 15 acres and of 8 acres suggest themselves as desirable. But the important point is that quite effective utilization was secured without the extra cost that this would involve. Hence it would seem that it is not always necessary to wait until expensive fencing has been carried out before attempting to obtain better utilization by systematic grazing; it is often profitable to proceed with the facilities that are on hand.

Two Useful Systems of Farm Subdivision.

When additional fences are to be erected, the decision where they should be placed generally calls for a good deal of thought and raises the important question of what system of subdivision should be adopted. A well-known system of proven merit, due to its convenience and simplicity, is that which involves the use of a narrow roadway or race running practically from back to front of the typical farm which has a relatively short road frontage and therefore is much deeper than it is broad. The orthodox narrow race or roadway is not always as desirable or economical as is sometimes assumed.

It is well to remember in this connection that the narrow race as a basis of farm subdivision did not originate under conditions similar to those obtaining on many farms to-day. Indeed, the conditions were often vitally different. This becomes clear from the fact that to-day we have many farms that pre-eminently consist of permanent grassland, a position which promises to become more rather than less marked in the future. On these pre-eminently grassland farms the passage of drays and cultivation implements, &c , becomes reduced materially. This correspondingly reduces the necessity for a solid and therefore costly roadway. These conditions which are now so frequently present are almost the opposite of those under which the narrow race won favour. To-day, when the narrow race has been

fenced off, the real roadway, on account of considerations of expenditure, is often omitted. Two markedly undesirable conditions attach to such a narrow race. In the first place, mud and slush to an unpleasant depth frequently are present. In the second place, when large herds of cattle have to pass along the narrow race injury by horning, &c., is apt to be incurred—a result which would be present whether the roadway is provided or not.

These considerations lead one to ask whether at times a long narrow paddock, rather than a narrow race, should not be utilized as a basis of farm subdivision. This idea is incorporated effectively in the subdivision of one of the most successful dairy-farms in the Dominion. This farm is 14 chains wide, and 55 acres in area. If on it a narrow race were utilized there would be a series of paddocks opening off the race, each of a depth of about 7 chains. Actually along each side of the farm there are paddocks 5 chains deep and these are separated by a central series 4 chains wide. Along these central paddocks the cows usually pass from the back to the front of the farm as occasion demands. This arrangement is not perfect, but it has two distinct advantages In the first place, muddy tracks are practically unknown, and in the second place, with the same length of internal fencing, three paddocks are obtained for every two that would be given by the central-race system of subdivision. This matter of the number of paddocks is specially worthy of note, because at times it is one of the prime considerations in subdivision which aims at better utilization. On this farm fifteen paddocks are utilized in the grazing of the dairy cows.

To some the number of paddocks provided may seem large, but actually it is in keeping with what was the practice of good farmers even before so much attention was being directed to the value of proper grazing-control. This is well shown by a farm survey made recently in which the following instances are typical of the subdivision provided by farmers who have been obtaining good results. The instances are as follows :—

Area of Farm in Acres	Number of Paddocks.	Area of Farm in Acres.	Number of Paddocks.
92	16	200	22
48	13	23	13
90	15	55	14
40	13		

Cases of similar subdivision are far less rare than are cases in which full advantage is taken of the possibilities of efficient pasture-utilization which such subdivision gives.

Factors determining the Size of Fields.

No farm layout can suitably serve as a model for general adoption in a detailed manner. The great range of variation in important respects that occurs on farms prevents this. All that the study of farm plans can serve to do is to stimulate thought and suggest ideas that may prove useful if incorporated into the working of other farms. The individual farmer must plan for himself the system of farm subdivision which best suits his circumstances.

The impossibility of drafting any fixed scheme of farm subdivision which would be of value for general use becomes obvious when consideration is given to the size of paddocks necessary in order to be able

to effect properly controlled grazing. In this connection the suitable size for paddocks will be determined by two main circumstances, both of which are likely to vary from farm to farm. These are the size of the herd and the fertility of the land. Of two farms carrying herds of the same size, one may consist of land so much more productive than that of the other that 4 acres of it will produce as much feed as 6 acres of the other. In such a case if on the farm of superior quality 4-acre fields are necessary in order to be able to effect properly controlled grazing, then 6-acre fields will suffice on the other farm. The size of paddocks that will admit of properly controlled grazing is also affected by a number of other factors, some of which are the density of the pasture, the rate of growth the amount of grass harrowing which is carried out, and the number of store stock carried in conjunction with wet stock. With such a number of factors to be considered it becomes impossible to lay down any hard-and-fast rules in respect to the number of stock to the acre which should be carried, and with this undetermined it follows that hard-and-fast rules in respect to size of paddocks are out of the question.

From the inter-relation between the control of grazing, size of fields, and other varying circumstances, such as rate of pasture-growth, it may be correctly inferred that uniformity in the size of fields on the same farm is not likely to be either necessary or desirable. An example of this fact is provided by a Horowhenua district farm of 200 acres, on which highly efficient pasture-utilization is achieved. On this farm the range of paddocks is as follows: One of 20 acres, three of 12 acres, one of 9 acres, one of 7 acres, two of 4 acres, one of 14 acres, four of 10 acres, two of 8 acres, three of 6 acres, and three of 2 acres. On this farm there were kept, in addition to 110 cows in milk, a considerable number of dry cattle and of sheep, but the farm is essentially devoted to butterfat-production.

Another example is provided by a Manawatu farm of 100 acres, which consists of the following fields: Two of 20 acres, three of 10 acres, one of 6 acres, one of 2 acres, one of 3 acres, and one of 1 acre, together with 1 acre of homestead. This farm wintered in 1929 a flock of 300 breeding-ewes, a herd of thirty-four dairy cows, and the normal quota of dry stock. It is likely that advantage would be gained by slight further subdivision in the case of both these farms, but quite good utilization has been possible without such subdivision.

From the instances cited it may be gathered that good results can be obtained in pasture-utilization on farms divided into about ten or twelve paddocks, but it should be kept in mind that further subdivision would probably give still better results. On a farm of ten to twelve paddocks of fairly even size often it may be possible to close up three or four paddocks for the production of hay and ensilage, leaving six to nine available for special crop production or grazing during the period of maximum pasture-growth.

How to determine Frequency of Grazing-periods.

If the fields under intermittent spelling and grazing are utilized when they carry enough growth to meet the requirements of the milking stock for about two days, then on a farm of ten to twelve paddocks it will be found that there will be suitable intervals of

spelling between successive grazing periods to allow of adequate development of pasture-growth. Although two days has just been mentioned as a suitable duration of grazing periods, it is not to be assumed that this is the most suitable duration under all circumstances.

Carefully recorded and supervised farm experience has shown that grazing periods of two days' duration have given excellent results. For instance, in connection with pasture-management investigations conducted by the Fields Division, records of the butterfat returns and of the duration of the grazing periods were kept for a complete season in respect to seventy good farms distributed in the Auckland, Wellington, and Taranaki districts. Seven of these farms were characterized by specially good grazing returns. On six of these seven specially good farms the great majority of the grazing periods were short—that is, of a duration of two days or less. But good results have also been obtained by the use of grazing periods both of longer and of shorter duration. The best stage of growth at which grazing-down of a pasture should be undertaken is decided not so much by the total amount of feed on a paddock as by the length and maturity of the growth of herbage. Hence an open pasture might call for stocking in the autumn, when it provided only one day's grazing, while a dense pasture would call for stocking when in the spring it provided two days' stocking at the same carrying-capacity.

It is of importance in deciding at what stage to graze a pasture to study not so much the average length of the growth as the length of growth on the richer patches of the field, which mark the vicinity of where animal manure has been deposited. If the growth of these richer areas is left untouched until the growth on the remainder of the field has reached the maximum length at which it may well be grazed, then difficulty will be experienced in dealing with the ranker growth on the specially enriched patches. Hence it is often well to take as a criterion for the commencement of grazing the state of the growth on the ranker portions of the field. As greater knowledge and greater proficiency in respect to grazing management is obtained, it is possible that opinions will be modified in regard to such matters as the best stage of growth at which to commence grazing.

The proper provision of an ample water-supply and of shelter are matters which call for more general attention than they receive. They are of such vital importance that they should rank as essential features of any scheme of dairy-farm subdivision, and they should not be sacrificed in order to secure merely convenient and orderly arrangement of paddocks.

To sum up: While successful pasture-utilization will often call for additional farm-fencing, yet often better utilization than is being obtained could be secured by employing to the best advantage the fencing already provided. The road to better pasture-utilization is not so much increased farm outlay as improved grasp of the principles and practice of properly controlled grazing. The vital feature of properly controlled grazing is the prevention as far as possible of the growth becoming so mature as to have reached the flowering stage Proper water-supply and shelter for the stock also call for careful attention.

WHEAT-MANURING EXPERIMENTS IN THE SOUTH ISLAND, SEASON 1929-30.

Fields Division, Department of Agriculture

THE programme of wheat-manuring experiments for 1929–30 comprised thirty-three trials located at different points from Marlborough to Central Otago. Thirty-two of these experiments are reported on in this article; the other one, which was a detailed study of the effect of applying different forms of soluble nitrogen at different times of application, will be reported on in a subsequent issue of the *Journal.*

The *Journal* for April, 1929, contained a summary of six years' wheat-manuring experiments. This report indicated that the investigation of certain problems had been carried to a definite conclusion. Consequently a slight modification was made in the 1929–30 programme.

The method of conducting the experiments has been described in the *Journal* for July, 1926, page 6.

Manures used in 1929–30: Two types of experiment were laid down, Type A being a continuation of the investigation of potash and nitrogen as adjuncts to superphosphate. The treatments used were as follows, all amounts stated being per acre:—

Experiment Type A—

(1)	No manure.	
(2)	Superphosphate (44/46 per cent. tricalcic phosphate) ..	1 cwt.
(3)	Super 1 cwt., plus muriate of potash 1 cwt	2 cwt.
(4)	Super 1 cwt., plus nitrate of soda 1 cwt.	2 cwt.
(5)	Super 1 cwt., plus muriate of potash 1 cwt., and nitrate of soda 1 cwt.	3 cwt.

(Eighteen experiments of this type were carried out.)

Experiment Type B—

(1)	No manure.	
(2)	Super	1 cwt.
(3)	Super	2 cwt.
(4)	Super 1 cwt., plus nitrate of soda 1 cwt.	2 cwt.
(5)	Super 2 cwt., plus nitrate of soda 1 cwt.	3 cwt.
(6)	Super 1 cwt., plus carbonate of lime 2 cwt.*	3 cwt.

(Fourteen experiments carried out.)

NOTE.—The nitrate of soda was top-dressed in the spring in all cases.

* Carbonate of lime was included because of the general response to lime from grassland in Canterbury, and because a number of farmers are using small quantities of carbonate of lime and claiming good results.

Size of plot and number of replications: Each plot was 2 chains in length and seven coulter rows wide. Twelve replications of each treatment were sown in each case, so that a Type A experiment consisted of sixty plots and a Type B of seventy-two.

Interpretation of results: Statistical examination of results was made by "Student's" method. Where a difference between one treatment and another is stated in this report to be "significant," full confidence can be attached to the results. A difference which is not significant may be due to chance variation and cannot be viewed as really reliable. Each yield as expressed is the average of twelve plots.

Estimation of profits from manures: After allowing per-bushel costs such as threshing, hauling, &c., each bushel of wheat is worth 5s. in round figures. One hundredweight of super costs approximately 6s., so that a little over a bushel increase will meet the cost of 1 cwt. of super.

Nitrate of soda costs 16s. per hundredweight at the present time. If the profit from the use of nitrogen is based on the average increase from all trials and nitrate of soda as above quoted there would be a margin of only 6s. per acre. Nitrogen in the form of sulphate of ammonia is considerably cheaper, however, 1 cwt. costing 12s. 8d Although the latter manure has not been used extensively in the Agriculture Department's trials. there is sufficient evidence to indicate that 1 cwt. of sulphate of ammonia (20·6 per cent. nitrogen) will give better results than 1 cwt. of nitrate of soda (15·5 per cent. nitrogen). Consequently the Department recommends farmers to use sulphate of ammonia at the present time. An increase of just over $2\frac{1}{2}$ bushels will pay for 1 cwt. per acre.

Muriate of potash costs about 14s. 6d. per hundredweight. Consequently just under 3 bushels of wheat are required to pay for 1 cwt. Potash as used has given increases in very few cases, and in no experiment has the increase in yield been sufficient to more than meet the cost of the manure.

RESULTS OF TYPE A EXPERIMENTS.

1. Co-operating Farmers: Smith Bros., Tua Marina, Marlborougn.

Experiment No. 16/3/337. Variety of wheat: Solid-straw Tuscan, 105 lb. per acre. Date sown: 28th August, 1929. Nitrate of Soda applied: 10th October, 1929. Date harvested: 12th February, 1930. Date threshed: 7th March, 1930. Previous crops: 1928–29, wheat; prior to this the field was in grass. Soil: Alluvial silt tending to be peaty.

Table 1.—Results of Smith Bros.' Experiment.

Treatment per Acre.	Bushels per Acre.		Remarks.	Profit per Acre.
	Yields.	Increase over No Manure.		
(1) No manure ..	35·1	..	..	..
(2) Super 1 cwt. ..	40·8	5·7	Significant increase ..	22s. 6d
(3) Super 1 cwt., plus muriate of potash 1 cwt.	42·8	7·7	Significant increase over super	18s.
(4) Super 1 cwt., plus nitrate of soda 1 cwt.	45·6	10·5	Significant increase over super	30s. 6d.
(5) Super 1 cwt., plus potash 1 cwt., plus nitrate of soda 1 cwt.	44·0	8·9	Significantly lower yield than super plus nitrate of soda	8s.

Comment on Table 1: The increase due to super is highly paying. The addition of potash to super has further increased the yield by 2 bushels per acre. The increase from potash is not a paying one. Nitrate of soda as an adjunct to super has caused an increase of 4·8 bushels over the yield from super; its use has been profitable. The

complete manure (treatment 5) shows a significantly lower yield than super plus nitrogen. This effect of reduced yield when muriate of potash has been combined with super and nitrate of soda has occurred on several occasions previously. (See *Journal* for April, 1929, page 227.)

2. H. D. Burt, Hawarden, North Canterbury.

Experiment No. 16/3/340. Variety of wheat: Solid-straw Tuscan, 90 lb. per acre. Date sown: 18th June, 1929. Nitrate of soda applied: 13th September, 1929. Date harvested: 22nd February, 1930. Date threshed: 27th February, 1930. Previous crops: In grass for three years. Soil: Clay loam overlaying shingle.

Table 2.—Result of H D Burt's Experiment.

Treatment per Acre	Bushels per Acre.		Remarks.	Profit or Loss per Acre
	Yields.	Increase over No Manure		
(1) No manure ..	19·9	..	..	..
(2) Super 1 cwt. ..	23·5	3·6	Significant increase ..	12s profit.
(3) Super 1 cwt., plus muriate of potash 1 cwt	23·9	4 0	Not significantly better than super	6d loss.
(4) Super 1 cwt, plus nitrate of soda 1 cwt	21·8	1·9	Not significantly different from super	12s. 6d. loss.
(5) Super 1 cwt., plus potash 1 cwt., plus nitrate of soda 1 cwt	24·7	4·8	Significantly better than super plus nitrate, but not better than super plus potash	12s 6d. loss.

Comments on Table 2: The increase due to super is paying. Potash as an addition to super has not affected yield materially. The addition of nitrate of soda to super has not been beneficial. The complete manure has given the best yield, but shows a monetary loss.

NOTE.—Unusual circumstances were experienced in connection with this experiment. Mr. Burt reports that an unusually severe frost at the end of October cut back the wheat on the manured plots, which showed better growth than the no-manure plots The no-manure plots were only slightly affected. The crop was still in the leaf stage at the time. It is very unusual for wheat to be badly affected by frost at this stage. The yield was extraordinarily low for this class of land. It is usually in the vicinity of 50 to 60 bushels per acre.

3. J. Wyllie, Omihi, North Canterbury.

Experiment No. 16/3/297. Variety of wheat: Solid-straw Tuscan, 95 lb. per acre. Date sown: 5th July, 1929. Nitrate of soda applied: 13th September, 1929. Date harvested: 24th January, 1930. Date threshed: 17th February, 1930. Previous crop: Grass. Soil: Silty loam.

The results are shown in Table 3 (next page).

Comments on Table 3: The increase from super is a paying one. None of the additional manures has had an appreciable effect on yield.

Table 3.—Results of J. Wyllie's Experiment.

Treatment per Acre.	Bushels per Acre		Remarks	Profit or Loss per Acre.
	Yields	Increase over No Manure		
(1) No manure ..	49·4	..	..	..
(2) Super 1 cwt ..	52·9	3 5	Significant increase ..	11s 6d profit.
(3) Super 1 cwt, plus muriate of potash 1 cwt.	51·9	2·5	Not significantly different from super	8s. loss.
(4) Super 1 cwt, plus nitrate of soda 1 cwt	53·9	4·5	Not significantly different from super	6d. profit.
(5) Super 1 cwt, plus potash 1 cwt., plus nitrate of soda 1 cwt	52·6	3·2	Not significantly different from other manurial treatments	20s 6d. loss.

4. H. Heinsch, Cust, North Canterbury.

Experiment No. 16/3/300. Variety of wheat: Solid-straw Tuscan, 120 lb. per acre. Date sown: 1st June, 1929. Nitrate of soda applied: 4th September, 1929. Date harvested: 3rd February, 1930. Date threshed: 19th February, 1930. Previous crop: Rape. Soil: Light silt loam.

Table 4.—Results of H. Heinsch's Experiment

Treatment per Acre.	Bushels per Acre.		Remarks.	Profit or Loss per Acre.
	Yields.	Increase over No Manure.		
(1) No manure ..	22·2	..	..	..
(2) Super 1 cwt. ..	25·5	3·3	Significant increase ..	10s. 6d profit.
(3) Super 1 cwt, plus muriate of potash 1 cwt.	25·7	3·5	Not significantly different from super	3s. loss.
(4) Super 1 cwt, plus nitrate of soda 1 cwt.	33·1	10·9	Significant increase over super	32s. 6d. profit.
(5) Super 1 cwt., plus potash 1 cwt, plus nitrate of soda	32·2	10·0	Significant increase over super plus potash. Significantly lower than super plus nitrate	13s. 6d. profit.

Comments on Table 4: Super has caused a paying increase. The addition of potash to super has had no appreciable effect on yield. Super plus nitrate of soda is 7·6 bushels better than super. The use of potash with super plus nitrate of soda has caused the yield to be depressed below that from super plus nitrate of soda by nearly 1 bushel. (See Table 1.)

5. G. H. Cross, Oxford, North Canterbury.

Experiment No. 16/3/301. Variety of wheat: Solid-straw Tuscan; 90 lb. per acre. Date sown: 31st May, 1929. Nitrate of soda applied: 5th September, 1929. Date harvested: 7th February, 1930. Date threshed: 21st February, 1930. Previous crop: Rape. Soil: Silty loam.

Table 5.—Results of G. H Cross's Experiment.

Treatment per Acre	Bushels per Acre		Remarks.	Profit per Acre.
	Yields	Increase over No Manure		
(1) No manure .	23·0	.	..	..
(2) Super 1 cwt .	29·7	6·7	Significant increase ..	27s. 6d
(3) Super 1 cwt., plus muriate of potash 1 cwt.	28·0	5·0	Not significantly different from super	4s. 6d.
(4) Super 1 cwt., plus nitrate of soda 1 cwt.	32·8	9·8	Significantly better than super	27s 6d.
(5) Super 1 cwt, plus potash 1 cwt., plus nitrate of soda 1 cwt	33·1	10·1	Significant increase over super plus potash	14s.

Comments on Table 5: The increase due to super is highly paying. Potash has no appreciable effect on yield. The addition of nitrate of soda to super has increased yield by 3·1 bushels and to super plus potash by 5·1 bushels per acre

6. T. Pearson, Hororata, Canterbury.

Experiment No. 16/3/302. Variety of wheat: Solid-straw Tuscan, 100 lb. per acre. Date sown: 7th June, 1929. Nitrate of soda applied: 6th September, 1929. Date harvested: 18th February, 1930. Date threshed: 26th February, 1930. Previous crop: Wheat. Soil: Clay loam.

Table 6.—Results of T. Pearson's Experiment.

Treatment per Acre.	Bushels per Acre		Remarks.	Profit or Loss per Acre.
	Yields	Increase over No Manure.		
(1) No manure.. ..	18·6	..	..	..
(2) Super .. .	20 0	1·4	Significant increase	1s profit
(3) Super 1 cwt., plus muriate of potash 1 cwt.	18·7	0·1	Significantly lower than super	20s. loss.
(4) Super 1 cwt., plus nitrate of soda, 1 cwt.	23·6	5·0	Significant increase over super	3s. profit.
(5) Super 1 cwt., plus potash 1 cwt, plus nitrate of soda 1 cwt.	23·2	4·6	Significant increase over super plus potash	13s. 6d. loss.

Comments on Table 6: The use of super has caused a small but paying increase. The addition of potash to super has caused the yield to be depressed below that from super. Nitrate of soda has been responsible for an increase of 3·6 bushels when used with super and an increase of 4·5 bushels when used with super plus potash.

7. J. D. Penny, Halkett, Canterbury.

Experiment No. 16/3/303. Variety of wheat: Solid-straw Tuscan, 100 lb. per acre. Date sown: 8th June, 1929. Nitrate of soda

applied: 6th September, 1929. Date harvested: 14th February, 1930. Date threshed: 25th February, 1930. Previous crops: Brown-top pasture for six years. Soil: Sandy loam.

Table 7.—Results of J. D. Perry's Experiment.

Treatment per Acre.	Bushels per Acre		Remarks.	Profit or Loss per Acre.
	Yields	Increase over No Manure		
(1) No manure.. ..	23·0	.	..	..
(2) Super 1 cwt. ..	26·4	3·4	Significant increase	11s profit.
(3) Super 1 cwt., plus muriate of potash 1 cwt.	25·7	2·7	Not significantly different than super	7s loss.
(4) Super 1 cwt. plus nitrate of potash 1 cwt	31·2	8·2	Significant increase over super	19s. profit.
(5) Super 1 cwt., plus potash 1 cwt., plus nitrate of soda 1 cwt.	30·5	7·5	Significant increase over super plus potash	1s. profit

Comments on Table 7: The applications of both super and nitrate of soda have been paying. Potash has had no beneficial effect on yield.

8. H. E. Evans, Fernside, North Canterbury.

Experiment No. 16 3·297. Variety of wheat: Solid-straw Tuscan, 100 lb per acre. Date sown: 4th July, 1929. Nitrate of soda applied: 4th September, 1929 Date harvested: 1st February, 1930. Date threshed: 18th February, 1930. Previous crop: Turnips. Soil: Light stony loam.

Table 8.—Results of H. E. Evans's Experiment.

Treatment per Acre.	Bushels per Acre		Remarks.	Profit or Loss per Acre.
	Yields	Increase over No Manure		
(1) No manure.. .	24·5	..	..	..
(2) Super 1 cwt. ..	27·0	2·5	Significant increase ..	6s 6d. profit.
(3) Super 1 cwt., plus muriate of potash 1 cwt	25·7	1·2	Significantly lower than super	14s. 6d. loss.
(4) Super 1 cwt, plus nitrate of soda 1 cwt.	27·1	2·6	Non-significant increase over super	9s. loss.
(5) Super 1 cwt, plus potash 1 cwt., plus nitrate of soda 1 cwt.	27·4	2·9	Significant increase over super plus potash	22s. loss.

Comments on Table 8: Super alone is the only treatment which shows a profit from its use. Potash added to super has depressed yield.

NOTE.—The nitrogen plots ripened earlier than the other plots, and a certain amount of grain was shaken before cutting.

9. H. R. Wilkinson, Chertsey, Mid-Canterbury.

Experiment No. 16/3/258. Variety of wheat: Solid-straw Tuscan, 93 lb. per acre. Date sown: 29th May, 1929. Nitrate of soda applied: 6th September, 1929. Date harvested: 7th February, 1930. Date threshed: 1st March, 1930. Previous crops: 1928–29, wheat; 1927–28, Italian rye-grass, clovers, and kale Soil: Light silty loam.

Table 9.—Results of H R Wilkinson's Experiment.

Treatment per Acre	Bushels per Acre		Remarks.	Profit or Loss per Acre.
	Yields.	Increase over No Manure		
(1) No manure.. ..	23·0	..	..	..
(2) Super 1 cwt ..	23·8	0·8	Increase not significant	2s loss
(3) Super 1 cwt., plus muriate of potash 1 cwt.	24·4	1·4	Increase over super not significant	13s 6d loss.
(4) Super 1 cwt, plus nitrate of soda, 1 cwt	31·7	8·7	Significant increase over super	21s 6d. profit.
(5) Super 1 cwt., plus potash 1 cwt., plus nitrate of soda 1 cwt.	30·9	7·9	Significant increase over super plus potash	3s profit

Comments on Table 9: Super and super plus potash have been unprofitable in use. Nitrate of soda has given excellent results on yield with both super and super plus potash. Without super it is highly probable that the nitrogen would have had very little effect.

10. W. and A. Campion, Highbank, Methven, Mid-Canterbury.

Experiment No. 16/3/260. Variety of wheat: Solid-straw Tuscan, 105 lb. per acre. Date sown: 5th June, 1929: Nitrate of soda applied: 17th September, 1929. Date harvested: 19th February, 1930. Date threshed: 12th March, 1930. Previous crops: 1928–29, wheat. Soil: Medium silty loam.

Table 10.—Results of W and A. Campion's Experiment

Treatment per Acre.	Bushels per Acre		Remarks	Profit or Loss per Acre.
	Yields	Increase over No Manure.		
(1) No manure.. ..	23·8	..	..	..
(2) Super 1 cwt ..	26·3	2·5	Significant increase over no manure	6s. 6d. profit.
(3) Super 1 cwt., plus muriate of potash 1 cwt.	26·3	2·5	Not significantly better than super	8s. loss
(4) Super 1 cwt., plus nitrate of soda 1 cwt.	33·3	9·5	Significant increase over super	25s. 6d. profit.
(5) Super 1 cwt, plus potash 1 cwt., plus nitrate of soda 1 cwt.	33·7	9·9	Significant increase over super plus potash	13s. profit.

Comments on Table 10: Both super and nitrate of soda have given paying increases. Potash has had no appreciable effect on yield.

11. J. Bland, Winchmore, Mid-Canterbury.

Experiment No. 16/3/154. Variety of wheat: Solid-straw Tuscan, 93 lb. per acre. Date sown: 21st May, 1929. Nitrate of soda applied: 17th September, 1929 Date harvested: 13th February, 1930. Date threshed: 10th March, 1930. Previous crop: 1928–29, wheat; 1927–28, turnips; 1926, grass. Soil: Silty loam.

Table 11.—Results of J. Bland's Experiment.

Treatment per Acre.	Bushels per Acre		Remarks.	Profit or Loss per Acre
	Yields	Increase over No Manure		
(1) No manure.. ..	33·6	..	..	..
(2) Super 1 cwt. ..	35·3	1·7	Significant increase over no manure	2s. profit
(3) Super 1 cwt., plus muriate of potash 1 cwt	35·0	1·4	Not significantly different from super	13s. 6d. loss.
(4) Super 1 cwt., plus nitrate of soda 1 cwt.	42·8	9·2	Significant increase over super	24s profit
(5) Super 1 cwt., plus potash 1 cwt., plus nitrate of soda 1 cwt.	42·0	8·4	Significant increase over super plus potash	5s. 6d profit.

Comments on Table 11: Both super and nitrate of soda have proved profitable in use. Potash has had no appreciable effect on yield.

12. G. Edgar, Rangitata, South Canterbury.

Experiment No. 16/3/375. Variety of wheat: Solid-straw Tuscan, 120 lb. per acre. Date sown: 6th August, 1929. Nitrate of soda applied: 9th October, 1929. Date harvested: 13th February, 1930. Date threshed: 13th March, 1930. Previous crops: 1928–29, rape; 1927–28, wheat; 1926, grass. Soil: Good sandy oam.

Table 12.—Results of G. Edgar's Experiment.

Treatment per Acre.	Bushels per Acre		Remarks	Profit or Loss per Acre.
	Yields	Increase over No Manure		
(1) No manure.. ..	48·8	..	..	..
(2) Super 1 cwt. ..	54·4	5·6	Significant increase ..	22s profit.
(3) Super 1 cwt., plus muriate of potash 1 cwt.	51·8	3·0	Significantly lower than super	5s 6d. loss.
(4) Super 1 cwt., plus nitrate of soda 1 cwt.	60·7	11·9	Significant increase over super	37s. 6d. profit.
(5) Super 1 cwt., plus potash 1 cwt., plus nitrate of soda 1 cwt	62·3	13·5	Significant increase over super plus potash, and super plus nitrate of soda	31s profit.

Comments on Table 12: Super and nitrate of soda have both proved highly paying. Potash added to super has depressed yield, but when used in conjunction with super and nitrate of soda, has increased the yield by 1·6 bushels per acre. The increase is not a paying one (compare this with Table 1).

13. Boys' High School, Timaru, South Canterbury.

Experiment No. 16/3/259. Variety of wheat: Solid-straw Tuscan, 120 lb. per acre. Date sown: 30th May, 1929. Nitrate of soda applied: 25th September, 1929. Date harvested: 10th February, 1930. Date threshed: 15th March 1930. Previous crop: Grass for several years. Soil: Cold clay flat.

Table 13.—Results of Experiment at Boys' High School, Timaru.

Treatment per Acre.	Bushels per Acre		Remarks.	Loss per Acre
	Yields	Increase over No Manure		
(1) No manure.. ..	26·8	..	..	..
(2) Super 1 cwt ..	27·2	0·4	Non-significant increase	4s.
(3) Super 1 cwt, plus muriate of potash	24·9	−1·9	Not significant, different from no manure and super	Dead loss.
(4) Super 1 cwt, plus nitrate of soda 1 cwt	28·7	1·9	Not significantly better than super	13s 6d
(5) Super 1 cwt, plus potash 1 cwt., plus nitrate of soda 1 cwt	29·0	2·2	Increase not significant	25s. 6d.

Comments on Table 13: None of the manures has affected yield to a significant extent. NOTE.—A good deal of this experiment was flooded in the winter and rust was bad in places.

14. F. Saunders, Studholme Junction, South Canterbury.

Experiment No. 16/3/113. Variety of wheat: Hunter's, 103 lb. per acre. Date sown: 15th May, 1929. Nitrate of soda applied: 26th September, 1929. Date harvested: 11th March, 1930. Date threshed: 17th March, 1930. Previous crops: 1928–29, potatoes; 1927–28, wheat; 1926, grass. Soil: Clay loam.

Table 14.—Results of F Saunders's Experiment.

Treatment per Acre.	Bushels per Acre.		Remarks.	Profit or Loss per Acre
	Yields	Increase over No Manure.		
(1) No manure.. ..	44·7	..	..	..
(2) Super 1 cwt. ..	50·4	5·7	Significant increase ..	22s. 6d profit
(3) Super 1 cwt, plus muriate of potash 1 cwt.	48·0	3·3	Significantly lower than super	4s. loss.
(4) Super 1 cwt, plus nitrate of soda 1 cwt.	53·6	8·9	Significantly better than super	22s. 6d. profit.
(5) Super 1 cwt, plus potash 1 cwt., plus nitrate of soda 1 cwt.	52·8	8·1	Significant increase over super plus potash	4s profit

Comments on Table 14: Super has been highly paying in effect. The addition of potash to super has depressed the yield. Nitrate of soda has increased yield when used with super just sufficiently to pay for its cost.

15. D. M. Borrie, Papakaio, North Otago.

Experiment No. 16 4 157. Variety of wheat: Solid-straw Tuscan, 120 lb. per acre. Date sown: 10th September, 1929. Nitrate of soda applied: 15th November, 1929. Date harvested: 26th February, 1930. Date threshed: 19th March, 1930. Previous crops: Turnips, rape, and wheat. Soil: Clay loam with clay subsoil.

Table 15.—Results of D. M. Borrie's Experiment.

Treatment per Acre	Bushels per Acre		Remarks.	Profit or Loss per Acre.
	Yields	Increase over No Manure		
(1) No manure.. ..	59·0	..	..	..
(2) Super 1 cwt. ..	62·8	3·8	Significant increase	13s. profit.
(3) Super 1 cwt., plus muriate of potash 1 cwt.	59·5	0·5	Not significantly different from super	18s. loss.
(4) Super 1 cwt., plus nitrate of soda 1 cwt.	62·4	3·4	Not significantly different from super	5s. loss
(5) Super 1 cwt., plus potash 1 cwt., plus nitrate of soda 1 cwt.	60·0	1·0	Not significantly different from super plus potash	31s. 6d. loss.

Comments on Table 15: Super alone is the only treatment which shows a paying return. The depression due to potash is not statistically significant, but it is highly probable that an actual depression has occurred. Nitrate of soda has had no effect.

16. J. Grant, Awamoa, North Otago.

Experiment No. 16 4 155. Variety of wheat: Solid-straw Tuscan, 120 lb. per acre. Date sown: 9th September, 1929. Nitrate of soda applied: 16th November, 1929. Date harvested: 25th February, 1930. Date threshed: 19th March, 1930. Previous crops: 1927–28, turnips; 1928–29, wheat. Soil: Stiff soil described locally as "tarry."

Table 16.—Results of J. Grant's Experiment.

Treatment per Acre	Bushels per Acre.		Remarks.	Profit or Loss per Acre.
	Yields	Increase over No Manure		
(1) No manure.. ..	15·6	..	..	..
(2) Super 1 cwt. ..	21·1	5·5	Significant increase ..	21s. 6d. profit.
(3) Super 1 cwt., plus muriate of potash 1 cwt.	19·0	3·4	Significantly lower than super	3s. 6d. loss.
(4) Super 1 cwt., plus nitrate of soda 1 cwt.	23·4	7·8	Significant increase over super	17s. profit
(5) Super 1 cwt., plus potash 1 cwt., plus nitrate of soda 1 cwt.	21·4	5·8	Significant increase over super, plus potash. Significantly lower than super plus nitrate of soda	7s. 6d. loss.

Comments on Table 16: Super has caused a highly paying increase. Potash has depressed yield. Nitrate of soda added to super has been responsible for an increase of 2·3 bushels over super alone. This increase does not meet the cost of nitrate of soda.

17. R. Kingan, Hawea, Central Otago.

Experiment No. 16/4/106. Variety of wheat: Solid-straw Tuscan, 120 lb. per acre Date sown · 30th May, 1929. Nitrate of soda applied: 23rd September, 1929. Date harvested: 13th February, 1930. Date threshed: 25th March, 1930. Previous crops: Bare fallow and wheat alternating (with one crop of barley previous to last fallow) for last six years. Soil: Clay loam with clay subsoil.

Table 17.—Results of R Kingan's Experiment

Treatment per Acre	Bushels per Acre		Remarks.	Profit or Loss per Acre.
	Yields	Increase over No Manure		
(1) No manure ..	30·3	..	..	..
(2) Super 1 cwt ..	32·9	2 6	Significant increase ..	7s profit
(3) Super 1 cwt, plus muriate of potash 1 cwt	31·9	1·6	Not significantly different from super	12s 6d loss
(4) Super 1 cwt., plus nitrate of soda 1 cwt	42·1	11·8	Significant increase over super	32s. profit
(5) Super 1 cwt., plus potash 1 cwt., plus nitrate of soda 1 cwt	40·1	9·8	Significant increase over super plus potash	12s. 6s. profit.

Comments on Table 17: Both super and nitrate of soda have been profitable in use, the nitrate of soda having increased the yield when added to super by 9·2 bushels per acre. Potash has a depressing tendency, although the depressions are not significant.

18. L. Lee, Arrowtown, Central Otago.

Experiment No. 16/4/108. Variety of wheat: Hunter's, 120 lb. per acre. Date sown: 1st June, 1929. Nitrate of soda applied: 6th September, 1929. Date harvested: 25th February, 1930. Date threshed: 27th March, 1930. Previous crops: In grass for sixteen years; ploughed out of lea and sown in wheat for three successive years. Soil: Clay loam with clay subsoil.

Table 18.—Results of L. Lee's Experiment.

Treatment per Acre	Bushels per Acre		Remarks.	Profit or Loss per Acre.
	Yields.	Increase over No Manure		
(1) No manure ..	34·6	..	..	..
(2) Super 1 cwt. ..	39·0	4·4	Significant increase ..	16s. profit.
(3) Super 1 cwt., plus muriate of potash 1 cwt.	36·8	2·2	Significantly lower than super	9s. 6d loss.
(4) Super 1 cwt, plus nitrate of soda 1 cwt.	43·5	8·9	Significant increase over super	22s. 6d. profit.
(5) Super 1 cwt., plus potash 1 cwt., plus nitrate of soda 1 cwt.	45·5	10·9	Significant increase over super plus potash	18s. profit.

Comments on Table 18: Super and nitrate of soda have both been paying. Potash added to super depressed the yield by 2·2 bushels. When used with super and nitrate of soda the yield is increased by potash, although the increase is barely significant.

RESULTS OF TYPE B EXPERIMENTS.

19. Edgar Smith, Tuamarina, Marlborough.

Experiment No. 16/3/338. Variety of wheat: Solid-straw Tuscan, 90 lb. per acre. Date sown: 27th August, 1929. Nitrate of soda applied: 10th October, 1929 Date harvested: 7th February, 1930. Date threshed: 7th March, 1930. Previous crops: 1928–29, peas; 1927–28, rape; 1926, pasture. Soil: Alluvial silt.

Table 19.—Results of Edgar Smith's Experiment.

Treatment per Acre	Bushels per Acre.		Remarks.	Profit per Acre.
	Yields	Increase over No Manure.		
(1) No manure ..	26·7	.	..	..
(2) Super 1 cwt ..	31·7	5·0	Significant increase over no manure	19s
(3) Super 2 cwt ..	34·2	7·5	Significant increase over super 1 cwt	25s 6d.
(4) Super 1 cwt, plus nitrate of soda 1 cwt	37·7	11·0	Significant increase over super 1 cwt	33s
(5) Super 2 cwt, plus nitrate of soda 1 cwt	39·8	13·1	Significant increase over super 2 cwt	37s 6d
(6) Super 1 cwt., plus lime 2 cwt *	31·5	4·8	Difference between this and super 1 cwt is not significant	16s.

* The cost of carbonate of lime is reckoned as £1 per ton (1s per cwt).

Comments on Table 19: Both super 1 cwt. and super 2 cwt. have given paying increases, the latter giving a bigger profit than the former. The addition of 1 cwt. of nitrate of soda to each of the super dressings has caused substantial increases. Super 1 cwt., plus nitrate of soda 1 cwt., is 6 bushels better than super 1 cwt.; and super 2 cwt., plus nitrate of soda 1 cwt. is 5·6 bushels better than super 2 cwt. The addition of lime has not affected the yield.

20. C. G. Amyes, Springbank, North Canterbury.

Experiment No. 16/3/4. Variety of wheat: Solid-straw Tuscan, 100 lb. per acre. Date sown: 30th May, 1929. Nitrate of soda applied: 4th September, 1929. Date harvested: 31st January, 1930. Date threshed: 18th February, 1930. Previous crop: Wheat. Soil: Clay loam.

Comments on Table 20: Both super 1 cwt. and super 2 cwt. have given paying increases, the latter being more profitable than the former. Nitrate of soda has had no effect on yield. Carbonate of lime has had no effect on yield.

Table 20.—Results of C. G. Amyes's Experiment.

Treatment per Acre.	Bushels per Acre		Remarks.	Profit per Acre
	Yields	Increase over No Manure.		
(1) No manure ..	22·5	..	..	..
(2) Super 1 cwt ..	29·5	7·0	Significant increase ..	29s.
(3) Super 2 cwt ..	31·8	9·3	Significant increase over super 1 cwt.	34s 6d.
(4) Super 1 cwt., plus nitrate of soda 1 cwt	28·7	6·2	Not significantly different from super 1 cwt.	9s.
(5) Super 2 cwt., plus nitrate of soda 1 cwt	31·7	9·2	Not significantly different from super 2 cwt.	18s
(6) Super 1 cwt., plus lime 2 cwt.	29·8	7·3	Not significantly different from super 1 cwt	28s. 6d.

21. D. Mulholland, Darfield, Canterbury.

Experiment No. 16/3/6. Variety of wheat: Solid-straw Tuscan 100 lb. per acre. Date sown: 27th June, 1929. Nitrate of soda applied: 6th September, 1929 Date harvested: 10th February, 1930. Date threshed: 26th February, 1930. Previous crop: 1928–29, wheat. Soil: Silty loam.

Table 21.—Results of D. Mulholland's Experiment

Treatment per Acre.	Bushels per Acre.		Remarks.	Profit per Acre.
	Yields.	Increase over No Manure.		
(1) No manure ..	33·8	..	..	..
(2) Super 1 cwt. ..	38·5	4·7	Significant increase ..	17s. 6d
(3) Super 2 cwt ..	37·1	3·3	Significantly lower than super 1 cwt	4s. 6d.
(4) Super 1 cwt., plus nitrate of soda 1 cwt	42·6	8·8	Significantly better than super 1 cwt.	22s.
(5) Super 2 cwt., plus nitrate of soda 1 cwt.	41·9	8·1	Significantly better than super 2 cwt.	12s. 6d.
(6) Super 1 cwt, plus lime 2 cwt	39·7	5·9	Not significantly different from super 1 cwt.	21s. 6d.

Comments on Table 21: Super 1 cwt. has given a paying return. Increasing the super to 2 cwt. per acre has resulted in a depression in yield of 1·4 bushels. Nitrate of soda has increased the yield by 4·1 and 4·8 bushels when added to super 1 cwt. and super 2 cwt. respectively. Lime has had no significant effect on yield.

22. R. Letham, Lauriston, Mid-Canterbury.

Experiment No. 16/3/266. Variety of wheat: Solid-straw Tuscan, 80 lb. per acre. Date sown: 6th June, 1929. Nitrate of soda applied: 1st October, 1929. Date harvested: 6th February, 1930. Date threshed: 5th March, 1930. Previous crop: Grass for several years. Soil: Light silty loam.

Table 22.—Results of R. Letham's Experiment.

Treatment per Acre.	Bushels per Acre.		Remarks.	Profit per Acre.
	Yields	Increase over No Manure.		
(1) No manure	16·5	..	..	..
(2) Super 1 cwt	21·1	4·6	Significant increase ..	17s.
(3) Super 2 cwt	22·3	5·8	Significantly better than super 1 cwt	17s
(4) Super 1 cwt., plus nitrate of soda 1 cwt	28·4	11·9	Significantly better than super 1 cwt	37s. 6d
(5) Super 2 cwt., plus nitrate of soda	28·2	11·7	Significantly better than super 2 cwt	30s 6d.
(6) Super 1 cwt., plus lime 2 cwt	23·1	6·6	Significantly better than super 1 cwt	25s

Comments on Table 22: Both super 1 cwt. and super 2 cwt have given paying increases. The increase of super 2 cwt. over super 1 cwt is just sufficient to meet the cost of the extra quantity of manure. The addition of nitrate of soda has increased the yield by 7·3 and 5·9 bushels over super 1 cwt. and super 2 cwt. respectively. Super plus lime has been responsible for an increase of 2 bushels per acre over super 1 cwt.

23. E. Body, Methven, Mid-Canterbury.

Experiment No. 16/3/158. Variety of wheat: Solid-straw Tuscan, 95 lb. per acre. Date sown: 22nd May, 1929. Nitrate of soda applied: 17th September, 1929. Date harvested: 12th February, 1930. Date threshed: 12th March, 1930. Previous crops. 1928–29, wheat; 1927–28, wheat following grass. Soil: Rich silty loam.

Table 23.—Results of E. Body's Experiment.

Treatment per Acre.	Bushels per Acre.		Remarks.	Profit per Acre.
	Yields.	Increase over No Manure.		
(1) No manure	42·4	..	..	..
(2) Super 1 cwt.	45·7	3·3	Significant increase ..	10s. 6d.
(3) Super 2 cwt.	45·5	3·1	Not significantly different from super 1 cwt	3s. 6d
(4) Super 1 cwt, plus nitrate of soda 1 cwt.	53·6	11·2	Significant increase over super 1 cwt.	34s.
(5) Super 2 cwt., plus nitrate of soda 1 cwt.	52·8	10·4	Significant increase over super 2 cwt.	23s.
(6) Super 1 cwt., plus lime 2 cwt.	45·7	3·3	Not different from super 1 cwt.	8s. 6d.

Comments on Table 23: Super 1 cwt. has been more profitable than super 2 cwt., as the increased phosphate had no effect on yield. The addition of nitrate of soda has increased the yield by 7·9 and 7·3 bushels over super 1 cwt. and 2 cwt. respectively. Lime has had no effect on yield.

24. S. Robinson, Methven, Mid-Canterbury.

Experiment No. 16/3/263. Variety of wheat: Marshall's, 105 lb. per acre. Date sown: 23rd May, 1929 Nitrate of soda applied: 17th September, 1929. Date harvested: 18th February, 1930 Date threshed: 11th March, 1930. Previous crops: 1928–29, wheat following grass. Soil: Silty loam.

Table 24.—Results of S. Robinson's Experiment.

Treatment per Acre	Bushels per Acre. Yields	Bushels per Acre. Increase over No Manure	Remarks.	Profit or Loss per Acre.
(1) No manure	20·5	..	..	..
(2) Super 1 cwt	21·5	1·0	Significant increase ..	1s loss.
(3) Super 2 cwt	21·7	1·2	Not significantly different from super 1 cwt.	6s. loss.
(4) Super 1 cwt, plus nitrate of soda 1 cwt	29·8	9·3	Significant increase over super 1 cwt.	24s. 6d. profit.
(5) Super 2 cwt, plus nitrate of soda 1 cwt.	30·1	9·6	Significant increase over super 2 cwt.	20s. profit.
(6) Super plus lime 2 cwt	21·5	1·0	Not significantly different from super 1 cwt.	3s. loss.

Comments on Table 24: Both super 1 cwt. and super 2 cwt. have increased the yield, but neither has proved paying. The addition of nitrate of soda has increased the yield by 8·3 and 8·4 bushels over super 1 cwt. and 2 cwt. respectively. Lime has had no effect on yield.

25. R. Campbell, Dromore, Mid-Canterbury.

Experiment No. 16/3/257. Variety of wheat: Solid-straw Tuscan, 90 lb. per acre. Date sown: 31st May, 1929. Nitrate of soda applied: 6th September, 1929. Date harvested: 3rd February, 1930. Date threshed: 28th February, 1930. Previous crops: 1928–29, oats; 1927–28, wheat following grass. Soil: Light loam with a few stones

Table 25.—Results of R. Campbell's Experiment.

Treatment per Acre.	Bushels per Acre. Yields.	Bushels per Acre. Increase over No Manure.	Remarks.	Profit per Acre.
(1) No manure	19·2	..	..	..
(2) Super 1 cwt.	21·6	2·4	Significant increase ..	6s.
(3) Super 2 cwt.	22·1	2·9	Not significantly different from super 1 cwt.	2s. 6d.
(4) Super 1 cwt., plus nitrate of soda 1 cwt	28·3	9·1	Significant increase over super 1 cwt.	23s. 6d.
(5) Super 2 cwt., plus nitrate of soda 1 cwt.	28·4	9·2	Significant increase over super 2 cwt.	18s.
(6) Super plus lime 2 cwt.	21·4	2·2	Not significantly different from super 1 cwt.	3s.

Comments on Table 25: Super 1 cwt. has given a paying increase. Super 2 cwt. is not materially better than super 1 cwt., and the cost of the extra manure has reduced the profit. The addition of nitrate of soda has increased the yield by 6·7 and 6·3 bushels over super 1 cwt. and 2 cwt. respectively. Lime has not affected the yield.

26. J. F. Langley, Somerton, Mid-Canterbury.

Experiment No. 16/3/262. Variety of wheat: Solid-straw Tuscan, 90 lb. per acre. Date sown: 24th May, 1929. Nitrate of soda applied: 1st October, 1929. Date harvested: 6th February, 1930. Date threshed: 1st March, 1930. Previous crops: 1928–29, wheat following grass. Soil: Silty loam.

Table 26.—Results of J. F. Langley's Experiment.

Treatment per Acre.	Bushels per Acre: Yields	Bushels per Acre: Increase over No Manure	Remarks.	Profit per Acre.
(1) No manure	47·9	..	..	..
(2) Super 1 cwt	53·2	5·3	Significant increase ..	20s. 6d.
(3) Super 2 cwt	52·6	4·7	Not significantly different from super 1 cwt.	11s. 6d.
(4) Super 1 cwt, plus nitrate of soda 1 cwt	57·2	9·3	Significant increase over super 1 cwt.	24s 6d
(5) Super 2 cwt, plus nitrate of soda 1 cwt.	59·3	11·4	Significant increase over super 1 cwt, and super 1 cwt. plus nitrate of soda 1 cwt	29s.
(6) Super plus lime 2 cwt	51·9	4·0	Not significantly different from super 1 cwt	12s.

Comments on Table 26: Super 1 cwt. and super 2 cwt. do not differ appreciably in their effect on yield. Both show a paying return. The addition of nitrate of soda to super 1 cwt. has increased yield by 4 bushels. When added to super 2 cwt. the increase is 6·7 bushels, thus enabling super 2 cwt. plus nitrate of soda 1 cwt. to show a greater profit. Lime has had no effect on yield.

27. J. W. Topham, Arowhenua, South Canterbury.

Experiment No. 16/3/111. Variety of wheat: Solid-straw Tuscan, 125 lb. per acre. Date sown: 9th July, 1929. Nitrate of soda applied: 10th October, 1929. Date harvested: 26th February, 1930. Date threshed: 14th March, 1930. Previous crops: 1928–29, peas; 1927–28, wheat; 1926, white clover; 1925, wheat. Soil: Rich alluvial silt.

Comments on Table 27: Both super 1 cwt. and super 2 cwt. have increased the yield, although super 2 cwt. has failed to give an appreciable increase over super 1 cwt. The addition of nitrate of soda has increased yields by 5·9 and 6·2 bushels over super 1 cwt. and 2 cwt. respectively. Lime has had no material effect on yield.

Table 27.—Results of J. W. Topham's Experiment.

Treatment per Acre.	Bushels per Acre		Remarks.	Profit per Acre.
	Yields.	Increase over No Manure.		
(1) No manure ..	39·6	..	..	..
(2) Super 1 cwt. ..	42·4	2·8	Significant increase ..	8s.
(3) Super 2 cwt ..	42·6	3·0	Not significantly different from super 1 cwt.	3s
(4) Super 1 cwt., plus nitrate of soda 1 cwt.	48·3	8·7	Significant increase over super 1 cwt	21s 6d.
(5) Super 2 cwt., plus nitrate of soda 1 cwt.	48·8	9·2	Significant increase over super 2 cwt	18s.
(6) Super 1 cwt., plus lime 2 cwt.	41·4	1·8	Not significantly better than super 1 cwt	1s

28. P. R. Talbot, Claremont, South Canterbury.

Experiment No. 16/3/112. Variety of wheat: Solid-straw Tuscan, 120 lb. per acre. Date sown: 22nd May, 1929. Nitrate of soda applied: 25th September, 1929. Date harvested: 12th February, 1930. Date threshed: 15th March, 1930. Previous crops: Grass for three years. Soil: Clay soil on downs.

Table 28.—Results of P. R. Talbot's Experiment.

Treatment per Acre	Bushels per Acre		Remarks.	Profit per Acre.
	Yields	Increase over No Manure		
(1) No manure ..	38·2	..	..	..
(2) Super 1 cwt. ..	43·1	4·9	Significant increase ..	18s. 6d.
(3) Super 2 cwt. ..	42·4	4·2	Not significantly different from super 1 cwt.	9s.
(4) Super 1 cwt., plus nitrate of soda 1 cwt	48·8	10·6	Significant increase over super 1 cwt.	31s.
(5) Super 2 cwt., plus nitrate of soda 1 cwt.	48·1	9·9	Significant increase over super 2 cwt.	21s. 6d.
(6) Super 1 cwt., plus lime 2 cwt.	44·3	6·1	Significant increase over super 1 cwt.	22s 6d.

Comments on Table 28: Super 1 cwt. and 2 cwt. do not differ appreciably in yield. The smaller quantity has proved more profitable. The addition of nitrate of soda has increased the yield by 5·7 bushels over super 1 cwt. and 2 cwt. respectively. The addition of lime to super has caused an increase of 1·2 bushels over super.

29. A. Davey, Waitohi, South Canterbury.

Experiment No. 16/3/360. Variety of wheat: Solid-straw Tuscan, 150 lb. per acre. Date sown: 15th August, 1929. Nitrate of soda applied: 22nd October, 1929. Date harvested: 14th February, 1930. Date threshed: 14th March, 1930. Previous crops: 1928–29, turnips; 1926–27, grass. Soil: Clay soil on downs.

Table 29.—Results of A. Davey's Experiment.

Treatment per Acre	Bushels per Acre: Yields	Bushels per Acre: Increase over No Manure	Remarks.	Profit per Acre
(1) No manure ..	14·1	..	..	..
(2) Super 1 cwt ..	17·2	3·1	Significant increase ..	9s. 6d.
(3) Super 2 cwt. .	17·8	3·7	Not significantly different from super 1 cwt	6s. 6d.
(4) Super 1 cwt., plus nitrate of soda 1 cwt.	20·4	6·3	Significant increase over super 1 cwt.	9s. 6d.
(5) Super 2 cwt., plus nitrate of soda 1 cwt	21·2	7·1	Significant increase over super 2 cwt. and super 1 cwt., plus nitrate of soda 1 cwt.	7s. 6d.
(6) Super plus lime 2 cwt.	16·7	2·6	Not significantly different from super 1 cwt.	5s

Comments on Table 29: Super 1 cwt. and super 2 cwt. have both given paying increases. Super 2 cwt. is not significantly better than super 1 cwt., and is less profitable. The addition of nitrate of soda has increased the yields by 3·2 and 3·4 bushels over super 1 cwt. and 2 cwt. respectively. The increases have just about met the cost of the manure. Lime has had no effect on yield.

30. D. Caird, Southburn, South Canterbury.

Experiment No. 16/3/110. Variety of wheat: Solid-straw Tuscan, 120 lb. per acre. Date sown: 24th May, 1929. Nitrate of soda applied: 24th September, 1929. Date harvested: 15th February, 1930. Date threshed: 17th March, 1930. Previous crops: 1928–29, rape; 1927–28, wheat and green feed; 1926, fallow; 1925, grass for five years. Soil: Clay soil on downs.

Table 30.—Results of D. Caird's Experiment.

Treatment per Acre	Bushels per Acre: Yields	Bushels per Acre: Increase over No Manure	Remarks.	Profit or Loss per Acre.
(1) No manure .	57·3	..	.	.
(2) Super 1 cwt	61·7	4·4	Significant increase ..	16s. profit
(3) Super 2 cwt. ..	59·4	2·1	Not significantly different from super 1 cwt	1s. 6d. loss.
(4) Super 1 cwt., plus nitrate of soda 1 cwt.	61·2	3·9	Ditto	2s. 6d. loss.
(5) Super 2 cwt., plus nitrate of soda 1 cwt.	59·6	2·3	,,	16s. 6d. loss.
(6) Super 1 cwt., plus lime 2 cwt.	60·4	3·1	,, . ..	7s. 6d loss.

Comments on Table 30: Super 1 cwt. has given a paying increase. None of the additional treatments has affected the yield to a significant extent.

31. E. Haugh, Duntroon, North Otago.

Experiment No. 16/4/158. Variety of wheat: College Hunter's, 120 lb. per acre. Date sown: 29th May, 1929. Nitrate of soda applied: 16th November, 1929. Date harvested: 21st February, 1930. Date threshed: 18th March, 1930. Previous crops: 1928–29, wheat; 1927–28, oats for green feed, 1926–27, wheat. Soil: Clay loam with clay subsoil.

Table 31.—Results of E. Haugh's Experiment.

Treatment per Acre.	Bushels per Acre. Yields.	Bushels per Acre. Increase over No Manure.	Remarks.	Profit per Acre.
(1) No manure ..	24·4	..	..	..
(2) Super 1 cwt. ..	28·6	4·2	Significant increase ..	15s.
(3) Super 2 cwt. ..	30·0	5·6	Not significantly better than super 1 cwt.	16s.
(4) Super 1 cwt., plus nitrate of soda 1 cwt.	32·7	8·3	Significant increase over super 1 cwt.	19s. 6d.
(5) Super 2 cwt., plus nitrate of soda 1 cwt.	33·2	8·8	Significant increase over super 2 cwt.	16s.
(6) Super 1 cwt., plus lime 2 cwt.	27·7	3·3	Not significantly different from super 1 cwt.	8s. 6d.

Comments on Table 31: Super 1 cwt. and super 2 cwt. have given paying increases, although their yields do not differ significantly. The addition of nitrate of soda has increased yields by 4·1 and 3·2 bushels over super 1 cwt. and 2 cwt. respectively. Lime has not influenced yield.

32. R. Dick, Weston, North Otago.

Experiment No. 16/4/156. Variety of wheat: College Hunter's, 105 lb. per acre. Date sown: 10th July, 1929. Nitrate of soda applied: 25th November, 1929. Date harvested: 20th February, 1930. Date threshed: 20th March, 1930. Previous crops: 1928–29, wheat; 1927–28, rape; 1926–27, wheat. Soil: Clay loam with clay subsoil.

Table 32.—Results of R. Dick's Experiment.

Treatment per Acre.	Bushels per Acre. Yields.	Bushels per Acre. Increase over No Manure.	Remarks.	Profit or Loss per Acre.
(1) No manure.. ..	27·7	..	..	..
(2) Super 1 cwt. ..	32·6	4·9	Significant increase ..	18s. 6d. profit.
(3) Super 2 cwt. ..	32·4	4·7	Not significantly different from super 1 cwt.	11s. 6d. profit
(4) Super 1 cwt., plus nitrate of soda 1 cwt.	38·6	10·9	Significant increase over super 1 cwt.	32s. 6d. profit.
(5) Super 2 cwt., plus nitrate of soda 1 cwt.	32·0	4·3	Not significantly different from super 2 cwt.	6s. 6d. loss.
(6) Super 1 cwt., plus lime 2 cwt.	30·7	3·0	Not significantly different from super 1 cwt.	7s. profit.

Comments on Table 32: Super 1 cwt. and super 2 cwt. both show paying increases, although the larger amount of super has not increased the yield over super 1 cwt. The addition of nitrate of soda to super 1 cwt has increased yield by 6 bushels over super 1 cwt., although the addition of nitrate of soda to super 2 cwt. has not affected the yield. This result is entirely anomalous, and cannot be accounted for. Lime has not affected yield.

SUMMARY OF RESULTS.

Table 33—Differences in Yields in Bushels per Acre between (a) *Super 1 cwt. and no Manure.* (b) *Super 1 cwt. plus Nitrate of Soda 1 cwt. and Super 1 cwt.,* (c) *Super 1 cwt. plus Nitrate of Soda 1 cwt. and no Manure. (Types A and B Experiments.)*

Experiment No. in Text.	Increase due to Manures: Increase of Super 1 cwt over no Manure.	Increase of Super 1 cwt. plus Nitrate/Soda 1 cwt. over Super 1 cwt.	Increase of Super 1 cwt. plus Nitrate/Soda 1 cwt over no Manure.	Experiment No. in Text.	Increase due to Manures: Increase of Super 1 cwt over no Manure.	Increase of Super 1 cwt plus Nitrate/Soda 1 cwt. over Super 1 cwt.	Increase of Super 1 cwt. plus Nitrate/Soda 1 cwt over no Manure.
1	**5·7**	**4·8**	**10·5**	17	**2·6**	**9·2**	**11·8**
2	**3·6**	−1·7	1·9	18	**4·4**	**4·5**	**8·9**
3	**3·5**	1·0	**4·5**	19	**5·0**	**6·0**	**11·0**
4	**3·3**	**7·6**	**10·9**	20	**7·0**	−0·8	**6·2**
5	**6·7**	**3·2**	**9·9**	21	**4·7**	**4·1**	**8·8**
6	**1·4**	**3·6**	**5·0**	22	**4·6**	**7·3**	**11·9**
7	**3·4**	**4·8**	**8·2**	23	**3·3**	**7·9**	**11·2**
8	**2·5**	0·1	**2·6**	24	**1·0**	**8·3**	**9·3**
9	0·8	**7·9**	**8·7**	25	**2·4**	**6·7**	**9·1**
10	**2·5**	**7·0**	**9·5**	26	**5·3**	**4·0**	**9·3**
11	**1·7**	**7·5**	**9·2**	27	**2·8**	**5·9**	**8·7**
12	**5·6**	**6·3**	**11·9**	28	**4·9**	**5·7**	**10·6**
13	0·4	1·5	1·9	29	**3·1**	**3·2**	**6·3**
14	**5·7**	**3·2**	**8·9**	30	**4·4**	−0·5	**3·9**
15	**3·8**	0·4	**4·2**	31	**4·2**	**4·1**	**8·3**
16	**5·5**	**2·3**	**7·8**	32	**4·9**	**6·0**	**10·9**

NOTES.—Increases printed in heavy type are statistically significant. A minus sign preceding a figure indicates a decrease.

Comments on Table 33.

Super 1 cwt.—Average increase due to super 1 cwt. (thirty-two experiments) equals 3·8 bushels per acre. Average profit due to super 1 cwt. equals 13s. per acre.

Super has increased the yield to a significant extent in thirty out of thirty-two experiments. In the other two experiments and in one of the thirty the increases were too small to meet the cost of 1 cwt. of super.

Nitrate of Soda.—Average increase due to nitrate of soda 1 cwt. equals 4·4 bushels per acre. Average profit per acre due to nitrate of soda 1 cwt. equals 6s. per acre.

Average increase due to super 1 cwt. plus nitrate of soda 1 cwt. equals 8·2 bushels per acre. Average profit per acre due to super 1 cwt. plus nitrate of soda 1 cwt. equals 19s. per acre.

Nitrate of soda has given significant increases in twenty-seven out of thirty-two experiments. In six of these twenty-seven the increases have not been sufficient to pay for the nitrate of soda (See comments on the use of sulphate of ammonia under "Recommendations to Farmers," page 51.)

Table 34.—Differences in Bushels per Acre (a) *when Super plus Potash is compared with Super,* (b) *when Super plus Potash plus Nitrate of Soda is compared with Super plus Nitrate of Soda,* (c) *when Super plus Potash plus Nitrate of Soda is compared with Super plus Potash. (Type A Experiments.)*

Experiment No. in Text	Super plus Potash—Increase or Decrease in Relation to Super 1 cwt.	Super plus Potash plus Nitrate of Soda.		Experiment No. in Text.	Super plus Potash—Increase or Decrease in Relation to Super 1 cwt	Super plus Potash plus Nitrate of Soda.	
		Increase or Decrease in Relation to Super plus Nitrate/Soda.	Increase or Decrease in Relation to Super plus Potash.			Increase or Decrease in Relation to Super plus Nitrate/Soda	Increase or Decrease in Relation to Super plus Potash.
1	**2·0**	**−1·6**	**1·2**	10	0·0	0·4	**7·4**
2	0·4	**2·9**	0·8	11	−0·3	−0·8	**7·0**
3	−1·0	−1·3	0·7	12	**−2·6**	**1·6**	**10·5**
4	0·2	−0·9	**6·5**	13	−2·2	0·3	4·0
5	−1·7	0·3	**5·1**	14	**−2·4**	−0·8	**4·8**
6	**−1·3**	−0·4	**4·5**	15	−3·3	−2·4	0·5
7	−0·7	−0·7	**4·8**	16	**−2·1**	**−2·0**	**2·4**
8	**−1·3**	0·3	**1·7**	17	−1·0	−2·0	**8·2**
9	0·6	−0·8	**6·5**	18	**−2·2**	2·0	**8·7**

NOTES.—Figures printed in heavy type represent statistically significant differences. A minus sign preceding a figure indicates a decrease

Comments on Table 34.

Potash.—Average decrease due to potash when used with super equals 0·9 bushels per acre. Average decrease due to potash when used with super and nitrate of soda equals 0·3 bushels per acre.

Potash used with super increased the yield significantly in one experiment only (No. 1). The increase was not a paying one. It depressed yield significantly in six experiments out of eighteen.

Potash used with super and nitrate of soda increased the yield significantly over that from super plus nitrate of soda in two experiments (Nos. 2 and 12). The increase of 2·9 bushels in Experiment 2 was just sufficient to meet the cost of the potash. It depressed yield definitely in two experiments.

In Experiment 1 potash used with super increased the yield by 2 bushels, but when used with super plus nitrate of soda the yield was depressed. (See reference to similar results in *Journal* for April, 1929, p. 227.) In Experiment 12 the reverse was the case.

Nitrate of Soda.—Average increase due to nitrate of soda when used with super and potash equals 4·7 bushels per acre.

Super plus potash plus nitrate of soda shows a superiority over super plus potash in all eighteen experiments. Although fourteen of these increases are significant, only eleven are paying. (See Table 33 for fuller details on nitrate of soda.)

Comparisons between Super 2 cwt. and Super 1 cwt.—Average increase of super 2 cwt. over super 1 cwt. equals 0·25 bushels per acre.

Super 2 cwt. was better than super 1 cwt. to a significant extent in two experiments (Nos. 19 and 20) out of fourteen. In Experiment 21 a definite depression in yield occurred as a result of using the larger quantity of super.

Comparison between Super 2 cwt. plus Nitrate of Soda 1 cwt. and Super 1 cwt. plus Nitrate of Soda 1 cwt.—Average decrease of super 2 cwt plus nitrate of soda 1 cwt. below super 1 cwt. plus nitrate of soda 1 cwt equals 0·1 bushel per acre. (Note—If the decrease in Experiment 32 is disregarded there is a superiority of 0·4 bushel in favour of super 2 cwt. plus nitrate of soda 1 cwt.)

In three experiments (Nos 19, 20, and 26) the treatment containing the greater quantity of super shows a significant superiority, in Experiment 32 a definite depression has resulted. (A comment is made regarding this under Table 32.)

Comparison between Super 1 cwt plus Lime 2 cwt and Super 1 cwt.—Average increase of super 1 cwt plus lime 2 cwt over super 1 cwt. equals 0·1 bushels per acre. In Experiments 22 and 28 the addition of lime has caused significant increases. The soils in the districts where these experiments were conducted respond markedly to lime, although some of the other experiments are on lime-response soils and do not show any appreciable effect from the use of 2 cwt. of lime.

Comparison between Responses from Super and Super plus Nitrate of Soda in 1928–29 Season and the same Manures in 1929–30.

On eight farms the following treatments were under trial in 1928–29 and again in 1929–30: (*a*) No manure, (*b*) super 1 cwt., (*c*) super 1 cwt. plus nitrate of soda 1 cwt.

Table 35.—Differences in Yield in Bushels per Acre between (a) *Super 2 cwt. and Super 1 cwt.*, (b) *Super 2 cwt. plus Nitrate of Soda 1 cwt. and Super 1 cwt. plus Nitrate of Soda 1 cwt.*, (c) *Super 1 cwt. plus Lime 2 cwt. and Super 1 cwt. (Type B Experiments.)*

Experiment No. in Text	Super 2 cwt.—Increase or Decrease in Relation to Super 1 cwt.	Super 2 cwt. plus Nitrate Soda 1 cwt.—Increase or Decrease in Relation to Super 1 cwt. plus Nitrate/Soda 1 cwt.	Super 1 cwt plus Lime 2 cwt.—Increase or Decrease in Relation to Super 1 cwt	Experiment No. in Text.	Super 2 cwt.—Increase or Decrease in Relation to Super 1 cwt	Super 2 cwt. plus Nitrate Soda 1 cwt—Increase or Decrease in Relation to Super 1 cwt. plus Nitrate/Soda 1 cwt	Super 1 cwt. plus Lime 2 cwt.—Increase or Decrease in Relation to Super 1 cwt.
19	**2·5**	**2·1**	−0·2	26	−0·6	**2·1**	−0·7
20	**2·3**	**3·0**	0 3	27	0·2	0·5	−1·0
21	**−1·4**	−0·7	1·2	28	−0·7	−0·7	**1·2**
22	1·2	−0·2	**2·0**	29	0·6	0·8	−0·5
23	−0·2	−0·8	0·0	30	−2·3	−1·6	−1·3
24	0·2	0·3	0·0	31	1·4	0·5	−0·9
25	0·5	0·1	−0·2	32	0·2	−6 6*	−1·9

* See comments on Table 32.

NOTES.—Figures printed in heavy type represent statistically significant differences. A minus sign preceding a figure indicates a decrease

Table 36.—Response in Bushels per Acre to Super 1 cwt. and Super 1 cwt. plus Nitrate of Soda 1 cwt., 1928–29 and 1929–30.

Name of Farmer.	Experiment No. in Text.	Super 1 cwt.—Increase over no Manure.		Super 1 cwt. plus Nitrate/Soda 1 cwt.—Increase over Super 1 cwt.		Super 1 cwt. plus Nitrate/Soda 1 cwt—Increase over no Manure.	
		1928–29.	1929–30	1928–29	1929–30.	1928–29.	1929–30.
C G. Amyes ..	20	10·4	7·0	6·4	−0·8	16·4	6·2
D Mulholland ..	21	7 9	4·7	6·2	4·1	14·1	8·8
E. Body ..	23	2·0	3·3	10·8	7·9	12·8	11·2
J. Bland ..	11	6·4	1·7	3·4	7·5	9·8	9·2
J. W. Topham ..	27	7·0	2·8	5·5	5·9	12 8	8·7
P. R Talbot ..	28	10·3	4·9	5·5	5·7	15·8	10·6
D Caird ..	30	6·3	4·4	0·0	−0·5	6·3	3·9
F. Saunders ..	14	3·8	5·7	2·0	3·2	5·8	8·9
Averages ..	..	**6·8**	**4·3**	**5·0**	**4·1**	**11·7**	**8·4**

Comments on Table 36.

Super Response.—On six of the eight farms the response to super was greater in 1928–29 than in 1929–30. The average for 1928–29 is 2·5 bushels greater than for 1929–30.

Nitrogen Response.—On one farm (No. 20) there was no response to nitrate of soda in 1929–30, although a good response occurred in 1928–29. On two farms the 1928–29 response was better and on four farms it was poorer than 1929–30.

Super plus Nitrate of Soda Response.—On seven farms the combined effect of super plus nitrate of soda was greater in 1928–29 than in 1929–30.

The number of farms under comparison is rather too small to draw definite conclusions from, but it would appear as though the 1928–29 season was the more favourable for manure responses. The 1929–30 season was a very dry one during the September to November period.

RECOMMENDATIONS TO FARMERS.

(1) Sow 1 cwt. of superphosphate with wheat at seeding. There is not sufficient evidence to warrant the recommendation of a greater quantity.

(2) Top-dress autumn- and winter-sown wheat, especially if it is inclined to be light in colour, with 1 cwt. of sulphate of ammonia per acre in late August or early September. Do not use nitrogen unless phosphate has already been used. Sulphate of ammonia is recommended because 1 cwt. costs about 12s. 8d., whereas 1 cwt. of nitrate of soda costs about 16s. Moreover, sulphate of ammonia contains 20·6 per cent. of nitrogen, whereas nitrate of soda contains 15·5 per cent. nitrogen. It is highly probable that 1 cwt. of sulphate of ammonia will give better results than 1 cwt. nitrate of soda (this point is being tested in the 1930–31 season), and the difference in profit should be greater than the difference in price between the two forms of nitrogen. A limited amount of evidence from experiments indicates that sulphate of ammonia should be applied two to four weeks earlier than nitrate of soda. If top-dressing with nitrogen is delayed until late September or early October it will be as well to use nitrate of soda.

(3) For spring-sown wheat mix equal parts of super and sulphate of ammonia, and sow at the rate of 2 cwt. per acre at sowing time; or sow 1 cwt. of super with the seed and top-dress with 1 cwt. sulphate of ammonia when the plants are about 3 in. high.

(4) Experiments conducted during the last five years indicate that the use of potash in Canterbury does not pay. Consequently its use is not recommended. Further work is required in Otago before a definite statement regarding potash can be made concerning that district.

The Department extends its thanks to the farmers who co-operated in the foregoing experiments.

The field work in connection with the experiments was carried out under the direction of Mr. R. McGillivray, Fields Superintendent, Christchurch, by Messrs. A. G. Elliott, Instructor in Agriculture, Marlborough, W. Stafford, Instructor in Agriculture, Christchurch (assisted by Instructors G. G. Calder and H. Chamberlain), E. M. Bates, Instructor in Agriculture, Ashburton, R. A. Calder, Instructor in Agriculture, Timaru, K. Montgomery, Fields Instructor, Timaru; and under the direction of Mr. R. B Tennent, Fields Superintendent, Dunedin, by Messrs. T. Sellwood, Instructor in Agriculture, Oamaru, and A. S. Duff, Instructor in Agriculture, Alexandra.

—*A. W. Hudson, Crop Experimentalist, Plant Research Station, Department of Agriculture, Palmerston North.*

LEAF-SPOT DISEASE OF THE TOBACCO-PLANT.

TOBACCO leaves from Rotorua affected by a leaf-spot disease were submitted to the Plant Research Station during the past season for examination. The numerous leaf-spots are at first brown in colour, later changing to almost white. In a number of instances the affected part falls away, giving the leaf a perforated appearance. The spots vary very much in shape and size, the shape being round and angular, and sometimes elongated, and the size from mere specks to ¼ in. in diameter. Among growers the disease is sometimes known as "angular leaf-spot," a term that is often rather loosely applied.

After making cultures from these affected leaves, the Mycologist reports: "The specimens have now yielded an organism known as *Macrosporium tabacinum*, recorded in America and South Africa as the cause of a condition identical with that present on the specimens supplied. This disease is probably transmitted with the seed, as are most species of *Alternaria* and *Macrosporium*. Disinfection of the seed is advisable, and of the seed-bed prior to sowing. Seedlings showing signs of the disease should be removed, and the remainder of the bed sprayed with Bordeaux 5–4–50, which at this stage will not damage the leaf."

A disease-preventive treatment for tobacco-seed is being worked out by the Mycologist, and it is hoped that some definite information on this matter will be available before long.

—*Horticulture Division.*

INVESTIGATION OF TAINT IN PORK.

AN interim report by Mr C. R Barnicoat, of the Dominion Laboratory, on the current investigation into taint sometimes found of late in New Zealand frozen pork, is published in the June issue of the *N.Z. Journal of Science and Technology*. It will be recalled that the matter arose through complaints from British buyers, who described the taint as a "fishy" or "reasty" odour, which developed after thawing of the meat. The trouble was attributed here, in general, firstly to defective feeding of pigs, and secondly to faulty freezing and storage of carcasses. The report summarizes the indications of the experiments carried out as follows:—

(1) Certain meals which have been made by the rendering of certain animal or fish offals appear, when given with buttermilk, to exert a predisposing influence to taint upon the fat of pigs fed on them.

(2) It is doubtful whether the same meals fed with a concentrate (*e g.*, barley) have this undesirable effect on the fat of those animals to which they have been fed

(3) Sides of pork from pigs fed on various diets, when frozen for three months under somewhat fluctuating air-temperature conditions which would allow of slight variations in carcass-temperatures, were, on careful thawing, free of taint.

(4) These sides cured satisfactorily, and the freezing had in no way developed taint in the carcass

(5) Carcasses submitted to very extreme fluctuating temperature conditions while in the frozen state rapidly became putrid-smelling in the flesh, rancid in the fat, and developed an unsightly, perished appearance.

Lord and Richter (Als Milch-Fleich Hygeine, 1929, xl, 15 Oct.) point out that fat-rich fish-meals can be used fairly freely for feeding pigs for consumption as pork, but that a warning is necessary against the feeding of such meals to pigs intended for the manufacture of bacon.

The local experiments have in every way confirmed these observations in so far that the various experimental feeds have not produced any sign of tallowy taint at the pork stage (even after freezing). It has always been after curing that the trouble has become apparent, except when the carcasses were purposely submitted to fluctuating temperatures in order to produce defective fat and meat, as described in Part I of this report.

INTERIM RETURN OF SHEEP AT 30th APRIL, 1930.

Sheep District	Number of Sheep. Final Returns, 1929	Number of Sheep. Interim Returns, 1930	Increase.
Auckland	2,734,171	3,300,485	566,314
Gisborne - Hawke's Bay ..	6,795,339	6,941,284	145,945
Wellington - West Coast ..	6,058,934	6,222,883	163,949
North Island totals ..	15,588,444	16,464,652	876,208
Marlborough–Nelson–Westland..	1,456,952	1,509,010	52,058
Canterbury–Kaikoura ..	5,827,573	6,028,390	200,817
Otago	6,178,413	6,635,338	456,925
South Island totals ..	13,462,938	14,172,738	709,800
Dominion totals ..	29,051,382	**30,637,390**	**1,586,008**

SEASONAL NOTES.

THE FARM.

Pasture-management.

If necessary harrowing of pastures has not already been attended to it should be carried out during the next few weeks If this is not done on fields in which animal manure is plentiful the spring pasture-growth will be very uneven, on account of the development of patches of rank herbage in the vicinity of where droppings have lain undisturbed for any considerable period. Such uneven growth presents a distinct hindrance to effective grazing-management during the months when the pastures are growing rapidly, unless special steps are taken to eliminate the patches of rank herbage. On farms carrying considerable numbers of dry stock which it is not desired to fatten immediately the objectionable rank patches can usually be removed by forcing the store dry stock to eat them out. But it is not at all easy to deal satisfactorily with rank patches of grass growth on farms supporting principally wet stock Hence in practice it proves most desirable to obviate the appearance of such patches by opportunely using the harrows to distribute the droppings before their fertilizing ingredients have been washed into the soil beneath

Top-dressing of sod-bound and mossy pastures is almost certain to prove much more effective when accompanied by relatively severe harrowing. The harrowing should be severe enough to open up the turf, and thereby give a chance to young plants and to plants of better species, whose presence is made possible by the increased fertility to develop vigorously. This will bring about the process known as pasture-rejuvenation, which is so desirable on many old - established permanent pastures which have deteriorated and which it is not economically feasible to renew by putting the land under the plough.

At times, towards the end of winter, coarse growth which was developed in the summer and autumn is still left ungrazed. Such growth is specially apt to occur on fields which have been grazed by horses or sheep alone, both of which consume the finer and neglect the rougher herbage Every effort should be made to remove such growth without delay, as it is a serious check on good herbage development in the spring. Its removal is particularly desirable where top-dressing is to be carried out, and most particularly so if nitrogenous manures are to be applied.

If top-dressing of grassland still remains to be done, superphosphate is the class of phosphate which should almost invariably be used at this season Field trials have shown that it will make its influence felt substantially in four weeks from the date of application at this time of the year.

Young pastures, and particularly those it is intended to make permanent, should be treated with special care during the winter and early spring The two extremes, undergrazing and overgrazing, should be equally avoided. Undergrazing, which is prone to occur in winter and early spring only when stock are being kept off young pastures specially to avoid "poaching" or "pugging" of the ground, will lead to suppression or weakening of valuable pasture species such as clovers and crested dogstail. Undergrazing is to be avoided by stocking sufficiently and, as far as possible, only in dry weather.

The damage from undergrazing is likely to be particularly heavy in the case of a young pasture which contains a large proportion of Italian ryegrass—a species which should never be allowed to become long in young

pastures Overgrazing, which is much more likely to happen in August than undergrazing, will readily lead to a setback to valuable species before they have properly established themselves.

Sheep may very suitably be employed in the winter grazing of young pastures provided too close grazing, which will take place if not guarded against, is not allowed to occur. The grazing by sheep of young pastures, when not overdone, is valuable, because of the even, thorough consolidation of the soil which it brings about.

In late winter the greatest harm to pastures may be done if ground is stocked when it is so wet and soft that it is not fit to carry stock. Stocking wet ground is what at times leads to invasion by markedly objectionable weeds such as docks, daisies, and buttercups Some of these weeds are occasionally cited as being indicative of want of drainage, but actually they often appear on land which is relatively well drained and which has been broken up by stocking when wet in the late winter

General Tillage Work.

During August every day on which soil-moisture conditions are favourable for cultivation work should be devoted to the turning-over of as much as possible of the land intended for cropping Areas which previously have been skim-ploughed should now be ploughed to the depth of the full furrow The policy of speeding the plough at this season is especially advisable in respect to cereal crops, but it does not apply to cereal crops alone. Land intended for lucerne, root, and other forage crops should be ploughed in August if possible When ploughing for these crops land which has been in grass it is often an advantage to fit to the plough the skimming-attachment, which assists in bringing about the complete burial of the turfy surface-layer. Without the use of the skimming-attachment twitches and other weeds are likely to make their appearance on the surface between the furrows.

Forage-crop Considerations.

The planning of the programme of forage-crop production for the coming season cannot safely be postponed much further. The experience of previous seasons may be useful as a guide for future work For instance, it is well to keep in mind the occurrence of any crop disease. It is definitely known that it is merely courting failure to sow cruciferous crops such as turnips, swedes, and rape on land on which club-root has attacked recent crops Onion-mildew and potato-blight are other instances to which the same principle applies Dairy-farmers as a rule should aim to provide some fresh, young, or non-woody forage to supplement their pastures as soon after Christmas as possible. If the summer happens to be a dry one, or if pasture-grazing management has not really been efficient, then herds will begin to fall off in their production at an unduly rapid rate soon after Christmas unless they are fed some highly digestible non-woody forage. Young green lucerne following a first cut of the crop removed in good time, the fresh-grass aftermath on a paddock from which ensilage was obtained at a suitably early date, and soft turnips of a quickly maturing type sown early are three sources of forage which may be widely resorted to for relief in this connection. In planning the summer forage-crop provision it is well to remember that the season may be better than may reasonably be expected, and that when this is the case it is in the interest of convenience and economy to be able to convert any surplus into hay or ensilage. If the summer forages consist entirely of crops such as soft turnips and rape it will be impossible to do this—another instance of the weakness of having all the eggs in one basket.

The experience of the current winter will have emphasized to many the inadequacy of their winter-forage provision—a matter that should receive much attention from now onward for some time.

If it is possible, grazing of established lucerne during winter and early spring in particular should be avoided. Grazing causes consolidation, which favours the invasion of the lucerne by rye-grass and *Poa annua*, two of its worst invaders. Grazing also keeps the growth short, which favours white clover, at times a detrimental competitor with lucerne for vital requirements. Young stands of lucerne especially should now be easily treated Harrowing of established weedy lucerne may be advisable at this season, but generally it is inadvisable unless the conditions allow one to lessen substantially the numbers of the invading weeds without unduly injuring the lucerne itself. Many seem inclined to cultivate lucerne as a matter of course and without due thought, and thus often do as much harm as good, or more so. It is well to remember always that the best way for lucerne to combat weeds is by virtue of its vigour obtained by good fertility, good drainage, and good utilization methods. The most profitable lucerne area is invariably that which combats weeds by its own aggressive vigour rather than by adventitious aids, such as surface-cultivation A point of practical importance at this season is that lucerne which is heavily invaded by grass should not be top-dressed in the early spring. It is normally better to delay the top-dressing until the first cut has been removed To top-dress in the early spring would lead to relatively greater stimulation of the grass than of the lucerne, and this would intensify the smothering effect of the grass, which is just what should be avoided.

In the liming of land under cultivation the ploughing-under of the lime should always be avoided. This is because normally lime is washed down through a soil more readily than is desirable, and it means that usually lime should be applied at about the time of sowing the seed, or later rather than earlier.

Italian rye-grass or Western Wolths, which often can be sown successfully at the end of August, may be looked upon as a special forage crop capable of providing hay or ensilage if necessary. Artichokes may be sown in mid-August or September They thrive on land naturally suited to potatoes, but they will also produce well on somewhat poor light soils, providing they are freely manured. From 8 to 10 cwt. of seed per acre is required. The seed should be sown in rows about 3 ft. apart, with a space of about 2 ft between the tubers in the rows. Generally a complete fertilizer may advantageously be used with artichokes. A mixture consisting of 2 cwt. super, 1 cwt. 30-per-cent. potash salts, and 1 cwt. blood-and-bone or sulphate of ammonia may be relied upon to give good results The ground for artichokes requires to be well worked before the sowing of the crop.

The Cereal Crops.

The attention of every wheatgrower may well be given to the report on the 1929–30 season wheat-manurial experiments published elsewhere in this issue of the *Journal*.

The ploughing of land intended for cereals should now receive attention ahead of almost all other tillage work. Experience has led to the greater part of the spring wheat crop being sown in August and early September. In some districts good crops may be obtained from later sowings, but as a rule good yields are not so generally obtained. The sowing of oats should ordinarily follow the wheat as opportunity offers. It often proves advantageous to sow Black Skinless barley in August. A heavier amount of seed requires to be used with spring-sown cereals than would be used with the corresponding crops sown in the autumn. For instance, in the main South Island wheatgrowing districts, while 1½ to 1¾ bushels of Tuscan seed is accepted as suitable for autumn sowing

2 bushels or more is used for spring sowing. Spring-sown cereals generally benefit from rolling of the ground after sowing, but, except in the case of light land, the rolling should not be done immediately after the drilling; rather it should be postponed until September or October.

When it is intended to produce a chaff or grain crop from autumn-sown cereals the final feeding-off should generally take place towards the end of August. An exception to this occurs in the case of crops on such rich ground that lodging may be expected. It is often well to arrange the final feeding-off of such crops in September as a means of obviating this. Ordinarily after the final feeding-off it is well worth while to give the ground a stroke or two of the tine harrows. This serves to open up the trampled soil and to scatter stock-droppings effectively. The spring feeding-off of cereals should be done by heavily stocking the ground for a short period at a time when it is not too wet. Light, prolonged stocking usually results in an uneven eating-down of the crop. Autumn-sown wheat which is somewhat thin may often with advantage be thickened out by tine-harrowing, even though it has not been eaten off

Those who are proposing to carry out spring-sowing of cereals should specially keep in mind seed-treatment for disease-control. This matter was discussed in these Notes last March. The treatment of seed of oats and barley is rightly receiving much more attention than was accorded it some years ago, but there is still much room for desirable improvement in this respect. A point often overlooked is that smut in an oat crop grown only for chaff is distinctly detrimental; hence the seed used in the production of such a crop should be suitably treated in the way described in the March *Journal*.

All barley-growers should acquaint themselves with the work being done in regard to the hot-water treatment of seed barley for the purpose of eliminating smut Full information may be obtained by applying to the Fields Division, Department of Agriculture. The value of the treatment is indicated by the fact that in the 1928–29 season the average yield of 4,331 acres of barley from treated seed was 53·5 bushels of firsts, while the average yield of 9,561 acres from untreated seed was 45·8 bushels, including seconds.

Miscellaneous.

August is one of the most critical months in the feeding of stock. The recovery of milking-cows and of ewes from a setback received in August because of underfeeding is often a very costly matter. The ravages of disease often originate from weakened vitality which arises at this stage. Yet farmers with stock unduly low in condition at this season often carry over reserves of forage. To say the least, the philosophy of their feeding-methods is difficult to understand.

The references to drainage in last month's Notes are equally relevant in respect to current farm-work. After wet weather the mole and tile drains should be inspected. Wet patches over drain-lines should be particularly watched for, as they may be indications of obstructions or breakages which affect the efficiency of a considerable portion of a drainage-system.

During wet weather attention may often well be given to the picking-over of stored potatoes and to the overhaul of implements in preparation for the busy season ahead.

In dry weather matters arising in connection with improved farm-subdivision, water-supply for stock, and the construction of ensilage-pits often may advantageously be given attention.

—*R. P. Connell, M.A., Fields Division, Palmerston North.*

THE ORCHARD.

Pruning.

THE season for pruning is drawing to a close, and the work remaining to be done should be expedited in order that these operations may be completed before growth commences. The tendency during recent years to adopt a system of long pruning or light thinning, in place of the general cutting-out and shortening-back, requires careful consideration Good results have been obtained under the newer system, but in any except the best land and under good growing-conditions there is a danger of growth decreasing to below the safety-point, with a detrimental effect upon the size of the fruit Any additional strain placed upon the tree's resources must be offset by more generous treatment in the application of manures and in cultivation.

Not the least important work in connection with pruning is the collection and burning of all prunings Many of the most destructive orchard diseases continue their development in dead wood, from which the infection is transferred to the young growth or fruit, and leaving heaps of prunings in the vicinity of the orchard is providing a breeding-place for diseases which may cause loss and expense later in the season This applies particularly to silver-leaf, which is annually causing losses in stone-fruit trees. In the normal development of this disease the spore-producing parts are not developed until after the death of the infected portion, and it is not uncommon to find active fructifications on stumps which have been dead for several years Under these conditions the spread of the disease must be expected, and only the complete destruction of all prunings or dead wood will remove the danger.

Grafting.

This operation is performed in the spring just after the sap has commenced to flow. Wood intended for use as scions should be gathered while the trees are dormant, and stored to retain its vitality and freshness. Good results are obtained by rolling the sticks in a damp sack, and completely burying them in a cool moist place until required. The object in removing the wood while dormant is to retard its development, so that when the grafting is performed the sap-flow is more active in the root than in the scion, thus providing immediate nutriment. Grafting before sap-movement commences may yield poor results owing to the scions drying out. Trees intended to be worked over may be headed back now to within about 1 ft. of where it is intended to graft, and further shortened to the desired height at the time of working, in order to have fresh plump bark which will quickly form a union. Some stone-fruits are unsatisfactory subjects for grafting, and will give better results if headed now with a view to budding into the young growth in the summer.

Cultivation.

Cultivation should be hurried on as opportunity permits. Delay in ploughing-in green crops may have a detrimental effect on growth in the spring, in as much as with the early cessation of wet weather the undecayed portion may keep the soil too open and produce conditions akin to drought. The manurial benefit of green manuring is required by the tree from the time that growth commences, and to obtain the full value decomposition or the conversion of the green matter into available plant-food should be well advanced by the time that the trees are in a suitable condition to utilize it.

As an adjunct to disease-control cultivation is an important item. Insect pests which hibernate during the winter in the ground or under the cover afforded by a growth of grass or weeds can be considerably reduced

in numbers if disturbed during their resting-period. Fungoid diseases overwintering on fallen fruit find conditions suitable to their development when provided with a covering of weeds. Under these conditions spore-discharge progresses, and with the aid of wind or any movement in the orchard the spores are carried to places suitable for their development, and fresh infection occurs The cultivation programme should be so arranged that operations can be suspended from shortly before and through the blossoming-period. In the normal life-cycle of some of the worst diseases the spores are being discharged at that time, and any fruiting bodies which have been partly buried may be brought to the surface and the liberation facilitated

Manuring.

The application of fertilizers will require early consideration. Orchards in districts which are subject to dry springs or where the rainfall is light should have their applications this month Quantities will vary according to the nature of the soil and the condition of the trees, but for good average soils with bearing trees in fair condition up to about 6 cwt. per acre would be a good dressing. Poor and light soils may require heavier annual dressings until satisfactory growth is stimulated. Manuring alone cannot be expected to promote activity in badly stunted and stagnant trees Generally this type is liberally covered with fruit-spurs, which during the winter season should be considerably reduced, and possibly a thinning of the fruit in following seasons will be beneficial.

Nitrogen in the form of nitrate of soda, sulphate of ammonia, dried blood, &c., acts as a stimulant to vegetation activity, and the quickly soluble forms should be applied just as growth is commencing. Excessive quantities may stimulate growth at the expense of fruit-production, and while the effects are being felt predispose the crop to bitter-pit. Phosphates promote fruitfulness, and annual applications are advisable for bearing-trees Potash provides the colour and finish to fruit, and is especially needed for starch and sugar production. A generally satisfactory mixture comprises four parts of high-grade superphospahte, one and a half parts of sulphate of ammonia, and one part of sulphate of potash, mixed and applied evenly over the orchard during the late autumn or winter. Home-mixing of manures permits of slight variations being made in the proportions to suit individual requirements of varieties or locations, and a certain amount of experimental work is necessary to ascertain the soil-requirements The lime content of the soil must be maintained to facilitate the action of manures.

Spraying.

Preparations for the spraying-season should be kept in view. An early overhaul of the spraying-plant and the completion of any repairs or renewals of doubtful parts may save costly delays when the season starts. The material required for the first sprays will be oil, and lime-sulphur or bordeaux, and stocks should be on hand. Oil is used as an insecticide, and has a beneficial effect on bark which has been hardened by the continued use of lime-sulphur or bordeaux. Lime-sulphur acts as a dual control of insects such as the various scales, red mite, &c., and as a fungicide ; bordeaux is a straight-out fungicide and is in general use for the first foundation spray.

Planting.

Planting should be completed as early as possible, but only if the land is sufficiently dry to permit free working without producing a soggy mass under the necessary treading to compact the soil round the roots. Deep planting to withstand the wind in exposed situations is to be avoided, and, if necessary, stakes should be provided to keep the trees stationary. Shelter planting should be completed and any gaps in existing shelters made up.

Citrus Culture.

Harvesting sufficiently advanced lemons will now be routine work. While the demand is good every effort should be made to satisfy market requirements. To enable the trees to proceed with wood-production and the development of the next crop all fruit should be removed when it has attained a size of approximately 2½ in. diameter or when the colour is silver-green or pale-yellow, and stored until the curing process has advanced sufficiently. The demand for oversize, coarse, tree-ripened fruit does not warrant its production, and it can be avoided if harvesting is conducted at regular intervals. Care in handling cannot be overstressed, for the slightest skin-puncture will provide a home for some of the rot-producing fungi. The removal of mould-infected fruit from the storage-trays needs special care to prevent the spores being broadcast throughout the store-room. Sweet oranges improve in quality if allowed to remain on the trees until fully ripe, when the inner skin or rag separates readily from the flesh, resulting in a much more desirable article.

Spraying: Cases frequently come under notice where citrus-trees are oil-sprayed at the same time as deciduous fruit-trees, with unfavourable results. Unlike deciduous trees the young citrus growth is not injured by oil at 1–40, but if it is applied before growth commences defoliation will result. Spraying, therefore, should be delayed until the growing tips show several inches of soft young wood.

Planting. September is usually a favourable month for planting, but in localities subject to late frosts it can be delayed, though the preparation can be proceeded with. Thorough and deep cultivation with the fall of the land is desirable, and ample provision should be made for the rapid escape of excess surface-moisture.

Pruning: The removal of exhausted or unsatisfactory twigs and a general thinning of overcrowded places can be performed now, and will assist materially in eliminating low-grade fruit.

—*G. H. McIndoe, Orchard Instructor, Dunedin*

POULTRY-KEEPING.

Management of the Breeding-birds.

AUGUST is a good period during which to hatch out chicks of any breed, hence next month the poultry-keeper's time will be chiefly devoted to the critical work of hatching and brooding the new flock. If success is to be achieved the necessity for maintaining the parent stock in proper breeding condition cannot be emphasized too strongly. This implies giving the birds a variety of grain foods such as wheat, oats, maize, &c., for it must be remembered that if properly developed chicks are to be produced the mated hen must be provided with the necessary elements to pass on desirable qualities to her offspring. No one class of food will fulfil all requirements in this respect, and the greater the variety of food supplied to breeding-birds the greater is the likelihood that good hatches and strong chicks will result. The dead-in-shell trouble during the various stages of the incubation process is invariably due to a weak germ, which may be traced back to the breeding-pen.

Breeding-birds should be induced to exercise as much as possible by such means as feeding the grain ration in deep litter. Nor should the liberal daily supply of green food be forgotten: a plentiful supply of succulent green material not only tends towards economic production, but in addition ensures the maintenance of healthy stock. With breeding-birds high egg-yields should not be aimed at, or trouble may be expected in the hatching

and rearing of the chicks, and for this reason meat, meat-meal, and other forcing-foods should be sparingly supplied, while condiments should never be included in the ration. The ideal condition for breeding-birds is a free range whereby natural food and exercise is available. I have seen eggs from birds kept in confinement and from those on free range placed in the same incubator. The eggs from the free-range bird could easily be picked out when testing during the incubation process by the strong embryo and the distinct contrast generally. It is not convenient for every one to give breeding-birds a natural run, but the aim should be to provide food and conditions as far as possible resembling those available on free range.

Selection of Eggs for Hatching.

It is well to reiterate that every care should be taken in selecting eggs for hatching purposes However good a bird may be as a layer, if its eggs are on the small size it should not be bred from. If the proposed system for grading eggs on the local market is carried into effect (by which eggs will be disposed of according to their weight), and there is reason to believe it will be in the near future, the size of the egg will then be considered of almost as much importance as the number produced. No doubt the weight clauses adopted in the egg-laying competitions have done much to check the production of small eggs, but, generally speaking, much remains yet to be done in this direction by producers before it can be said that the bulk of the eggs that reach the market conform to the first-grade standard of 2 oz.

It must be admitted that under the present crude system of marketing the producer has little if any inducement to breed for large eggs, as these command no better price on the local market than do those of medium size. Eggs for export are sold according to their weight per long hundred (or ten dozen). The sooner this system is adopted on the local market the greater will be the tendency for the industry to become stabilized. At the present time egg-pulp is sold by weight, and there is no reason why eggs in shell should not be disposed of in a similar manner.

Parasitic Infestation and its Treatment.

It is safe to assume that, with the exception of the commonly adopted but weak policy of underfeeding fowls, parasitic infestation is more responsible for the unthrifty flocks seen and the low egg-yields secured than any other cause. In previous issues of the *Journal* particulars have been published regarding experiments conducted at the Wallaceville Poultry Station on ridding fowls of insect pests by the use of the nicotine specific Black Leaf 40. The results of the experiments demonstrated that these parasites can be more rapidly and effectively destroyed, and with less harmful effects to the productive capacity of the flock, by the use of Black Leaf 40 than probably by any other means yet discovered.

In a general way it is an easy matter to ascertain by searching among the feathers of a bird whether insect pests are present or not, but this is not the case with intestinal parasites which affect poultry. When birds are suffering from the effects of intestinal worms the symptoms are often so similar to those which manifest themselves in certain forms of disease that a *post-mortem* examination is the one and only means of making sure of their presence; indeed, there are certain kinds of worms which can be located only by means of the microscope. Among other species of these enemies of the domesticated fowl is a small tapeworm which usually makes its home in the upper part of the intestines and is so minute as to be invisible to the naked eye. Lately many cases have come under my notice, particularly of pullets, which in spite of being provided with good food and management failed to thrive and come into profit when expected, their owners being usually at a loss to know the cause. The birds in most instances were practically devoid of flesh, and showed similar symptoms in many respects

to birds suffering from tuberculosis. As a result, however, of investigation at the Department's Veterinary Laboratory the fact was disclosed that in all cases the impaired and unthrifty condition was due to intestinal parasitic infestation and nothing else

Several experiments have been tried on the treatment of birds affected in this way, but the use of Black Leaf 40 gave the most satisfactory results. The birds were starved for a day before the dose was given, and Black Leaf 40 was used in the proportion of one liquid ounce for each hundred adult birds. This was added to the water with which the mash was moistened. In the same water ½ lb. of Epsoms salts was also added and well dissolved before stirring in the mash. Sufficient mash was moistened with the water mixed with the Black Leaf 40 and salts, so that each bird had about 1 oz. of the mash. It is important for the troughs to be sufficiently long, so that all birds in the flock can feed at once and in comfort. It must be clearly understood that Black Leaf 40 is poisonous, and on no account must the dose stated be increased, or fatal results may follow. In most cases for a few minutes after the birds have eaten the mash they will lose the power of their legs and give indications that they are likely to succumb under the treatment. This condition, however, will be of short duration, as the birds will soon regain a normal state, providing of course the amount of Black Leaf 40 is not given in excess of the quantity stated. When small flocks are to be treated it is a good plan to add 9 oz. of water to 1 oz. of Black Leaf 40, and to use 1 oz. of this mixture for every ten birds.

A common indication of worms is when the birds stretch their necks and make a screeching noise somewhat similar to a seagull; while other symptoms are poor condition, feathers loose and ruffled, comb and face pale, with frequent yawning. The effect of this treatment given after a fast will be to expel the worms. It is well to confine the affected birds to the house for at least a day after being treated, so that the cleaning-up process may be properly carried out, thus avoiding the risk of the runs becoming further infested. Care must be taken to thoroughly clean up and remove all droppings after the treatment, while, in addition, the quarters should be given a good spraying with a strong disinfectant. It is a good plan to place wire netting over and in front of the perches, so that the birds will not have an opportunity of picking among the droppings after being treated. The treatment may be repeated in, say, two weeks time.

As is the case with most troubles affecting poultry, the only feasible way of dealing with intestinal parasitic infestation is by preventive measures, which include maintaining the birds in good health and vigour by sound and liberal feeding, together with strict attention to cleanliness, and not allowing the runs to become poultry-sick.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Starting Beekeeping: Hints for Beginners.

THE spring is the best season of the year for starting beekeeping, especially for the beginner who is unacquainted with the practical care of bees. The time is therefore at hand when arrangements should be made for the purchase of bees and equipment. If the bees are obtainable locally the prospective beekeepers can make arrangements for the purchase of established colonies or he can wait until swarming-time when swarms are available. Perhaps the most satisfactory way is to purchase some established colonies from a neighbouring beekeeper and move them home before too much brood is present in the hives. No harm will come to bees moved in the colder months,

the same provision for screening not being so essential as when moved during the summer months Screening the hives top and bottom is not necessary if the bees are moved only a short distance, and if the beekeeper takes the precaution of tacking a piece of wire gauze across the front entrance, this will prevent suffocation and make for safe handling in transit.

The beginner will be well advised to procure only strong healthy colonies from a reliable beekeeper who can furnish a guarantee that the bees are healthy. Upon this depends much of his future success. The keystone to this condition is the permit issued by an Apiary Inspector under the Apiaries Act The first question to be asked by the beginner of the seller is, "Have you the necessary permit to sell?" If this is forthcoming he may rest assured that he has a reasonable chance of getting clean bees, apart from any of the other conditions which go to make a good hive Although the purchase of first-class colonies is probably the most expensive way to commence beekeeping, they have the advantage that they are more easily kept in order than colonies which have been neglected, and which require to have corrected the faults of the previous owner who has not learned to make his beekeeping profitable.

Since it cannot be expected that the beginner should know what constitutes a good colony, he should only deal with a beekeeper of some standing. Everything with bees depends upon starting right. The possession of a colony in prime-working condition gives the beekeeper a standard with which to compare other colonies, and enables him to avoid costly mistakes in their management. If the cost of starting a small apiary has to be considered the beginner will find it an advantage to arrange for the purchase of as many first swarms as are wanted. These may be obtained in boxes, and subsequently transferred to frame hives Only early and prime swarms should be stipulated for, otherwise they will not build up in time for a crop.

The hives when placed in their permanent position should be sheltered and face the north Protection from cold winds is important, but the hives should not be placed under trees, as this has a tendency to make the bees vicious. The hives should be set on four bricks, as this allows for a free circulation of air under the bottom-boards, which will rot if placed directly on the ground. The hives require to be level crosswise and have a slight cant lengthwise This prevents driving rains from lodging within the hives, which is likely to render the combs mouldy. A watertight roof and sound bottom-board are just as essential to the welfare of bees as are good floors and roofs in human dwellings.

A certain amount of working equipment is necessary However, if provision is made for a smoker, bee-veil, hive-tool, and a pair of gloves, such other articles can be added as they are needed. Until such time as the beginner has got used to the stings he will find it an advantage to wear gloves, although he should accustom himself to do without them. In the course of time gloves become impregnated with poison, and this will irritate one's flesh on hot days; moreover, it is resented by the bees. There is much difference in the temper of bees, Blacks being much more troublesome to handle than Italians, but with a little care in carrying out hive-manipulations and the free use of smoke most colonies can be handled with very few stings.

At all times when handling bees the beginner should be prepared to complete the work and not allow himself to be driven from the hives. By "the free use of smoke" it is not meant that the bees should receive an overdose, as this may demoralize them and render them liable to attack from other colonies. Moreover, it does not bring them under control, but tends to aggravate them. It has the further dis-

advantage that as the bees are driven from the combs they form in clusters on the bottoms of the frames and the sides of the hives, making it well-nigh impossible to locate the queen and to carry out other essential work with any degree of success.

The best fuel for the smoker is dry, clean sacking, no other material being as good. Avoid oily waste and cotton materials, as the smoke from these articles makes the bees vicious. When starting to manipulate a hive puff a little smoke in at the entrance, and, having removed the roof, puff a little more smoke on the frames as the mat is peeled off This operation being complete, the frame nearest to the operator can be taken out, allowing of the prizing-apart of the remainder of the frames preparatory to making a complete examination of the whole When handling bees all operations are best carried out in a gentle manner, avoiding at all times quick movements and clumsy manipulations which may crush them. It must be remembered that nothing irritates bees more than the odour of the poison which fills the air when bees are crushed.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

The Tomato Crops.

THE tomato crop under glass is usually planted out, in the middle districts, towards the end of August. It is important to plant deeply and firmly. While such houses should be aired well at every opportunity in fine warm weather, the ventilators should be closed early in the afternoon before the temperatures commence to fall; 55° to 65° F. is a suitable range. If the temperature is allowed to rise much above this maximum it makes the plants tender and more liable to injury during a cold snap.

Fresh stable manure should be accumulated for hot-beds and carefully prepared. When it is in a suitable condition a foot or two in the bottom of a glass frame will provide sufficient heat, in moderately warm districts, on which to place seed-boxes for raising tomato and other half-hardy plants. In cold districts the usual hot-bed, 2 ft. to 3 ft. in height, will be required, and the frame placed on top. In large establishments the sterilization of the soil for seed-boxes has become a usual practice and much difficulty is avoided in this manner; but fungus troubles sometimes do occur, and in such cases a solution of permanganate of potash is an easy and convenient remedy. A stock solution may be made up, and a small quantity, diluted as required to a pink colour, may be sprayed on the plants from time to time, or they may be watered from a can with a fine rose. The permanganate may be used up to a strength of 1 oz. to 2 oz. of crystals to 4 gallons of water.

Small-fruits.

Light cultivation in bright dry weather should be given to increase fertility and destroy seedling weeds. In many instances at this season it is advisable to apply bonedust and other suitable fertilizers between the rows just before hoeing, and so work the material well into the soil.

The Market-garden.

As the rising temperatures encourage the growth of weeds as well as crops, the former should be eliminated from the competition before they gain any size. This is best done in bright windy weather, and every opportunity of the kind should be taken. This operation also increases fertility and affords a suitable occasion for working in such dressings of fertilizers as may be required. Not only should growing crops be given

this treatment, but it is also an excellent method of completing the preparation of fallow land for planting or sowing.

Spring cabbage, cauliflower, and salad plants generally that have been planted out and are now well established will receive benefit from a dressing of sulphate of ammonia at the rate of 1 oz. to the square yard, repeating the dressing two to three weeks later. Manure also established crops of asparagus and rhubarb; they both have healthy appetites and respond to generous feeding.

Crops of parsnips left in the ground over winter should now be lifted, or a second growth will spoil the flavour. If they are stored in dark, cool, humid conditions they will remain useful as long as possible. Late-sown carrots should also be lifted to avoid splitting.

How to make an early crop of broad beans "set" is a problem which often receives consideration, and ends usually in blaming the bees for destroying the flowers. The truth seems to be that the bee punctures the base of the flower as the shortest cut to the supply of nectar, which it takes without rendering the plant the kindly assistance in pollination with which bees are generally credited. Seeing a quantity of bean straw in the early summer that had evidently borne a heavy crop, the problem was raised with the grower, who stated that his method was to use a switch on the plants a few times when in flower and during the middle of a fine day. He stated that he had used the method for two or three seasons with good results each time. The switch is made of a bundle of fine twigs, such as manuka or birch. This treatment evidently improves the distribution of pollen, and is well worth a trial. We are indebted to Mr. H. J. Gilberd, of Epsom, Auckland, for this demonstration, which will very possibly be found generally useful.

Towards the end of the month in most districts cucumbers may be planted out in heated glasshouses suitable for the purpose Set the plants deeply and not too firmly in mounds or ridges composed of two parts good fibrous loam mixed with one part of decomposed stable manure and a 5-in. pot of bonedust to every barrow-load of the compost Let the leader growth run to the top wire before stopping, and stop the lateral growth at the first point beyond the young fruit. When the temperature rises to 90° F. ventilation should be given. As the white rootlets push through the surface of the soil a top-dressing of the above-mentioned compost should be made.

The main crop of parsnips should now be sown, as they require a long season of growth; also melons and cucumbers under glass for planting outside later. Sow also, outside, early carrots, turnip-rooted beet, broad beans, main-crop cabbage and cauliflower, lettuce, early peas, parsley, spinach, and turnips. Sow thinly, and so reduce the work of thinning the young plants later. An amount of 1 oz. or 2 oz. of superphosphate per square yard before sowing, and a light dressing of nitrate of soda after thinning, will suit most of these crops.

Where it is intended to plant out permanent beds of asparagus and rhubarb this should be done now if the land is rich, clean, and deeply cultivated. Without this preparation it is best to defer the planting for another season. For asparagus plantings good selected one-year-old plants are best They should be set deeply 18 in. to 24 in. apart, with 4 ft. between the rows, when planting large areas. For commercial cropping a moist, sandy, well-drained loam is required. Where small areas are being dealt with the best spacing generally is 18 in. between plants, and between the rows 18 in. and 4 ft. alternately, thus making beds about 3 ft. wide with alleys between. Early potatoes and artichokes may also be planted.

The Home Garden.

The planting season, for trees and shrubs especially, practically ends with the month of August, and any work of the kind that is to be done should be carried out without further delay. One or two choice decorative

plants that have been overlooked generally are Lapageria and Polianthes. The former is an evergreen climber from Chile It is often grown under glass in this country, but should do well out of doors in the warmer districts if planted in a shaded place in rich well-drained soil and where it may be given plenty of water during the growing-season. It is likely to thrive best where it can ramble through a tree of moderate size and rather open. Rosea, albiflora, and superba (crimson) all carry bell-shaped flowers of a large size and great substance. *Polianthes tuberosa* is the well-known tuberose, a bulbous plant producing flowers of great fragrance in the autumn. If planted now in a rich soil on a warm, sheltered border it should be quite satisfactory in the milder localities.

Evergreen hedges that will stand hard cutting and have been allowed to get out of hand may now be given the necessary hard pruning to bring them back into shape. In northern districts this may be done towards the end of August, and disfigurement is soon made good by the appearance of new growth. In Southern districts the work is best deferred for another month. The same periods may be observed for pruning roses. In doing this work the common mistake is to thin the growth insufficiently. With young plants recently set out they should not only have the branches well thinned out, but those remaining should be cut back rather more severely than usual.

Where new lawns are to be sown down the work should be completed as soon as possible.

—*W. C. Hyde, Horticulturist, Wellington.*

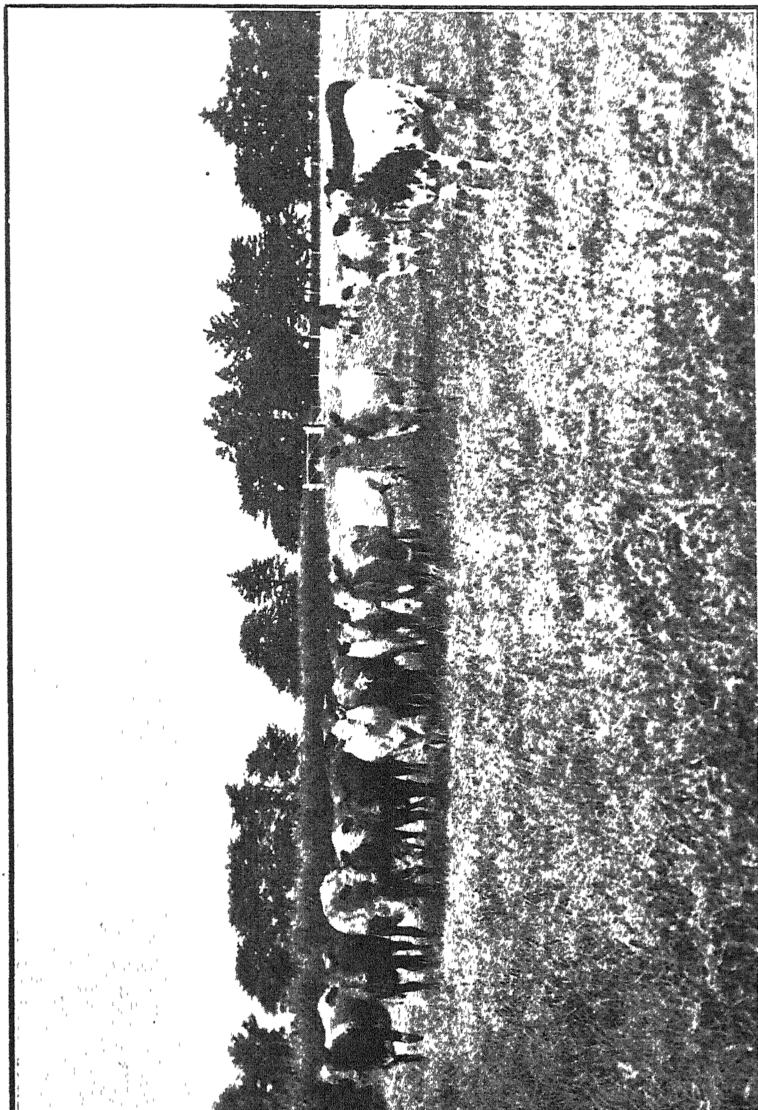
DAIRY FACTORIES IN NEW ZEALAND, 1930.

THE following table presents the registrations of factories under the Dairy Industry Act as at 31st March last, together with the quantities of butter and cheese forwarded to grading-stores for export during the year ended 31st March, 1929, and the numbers of milk or cream suppliers to the factories :—

District.	Number of Factories.				Forwarded for Export, 1929-30.		Number of Suppliers to Factories.	
	Butter.	Cheese.	Dual Plant.	Total.	Butter.	Cheese.	Butter.	Cheese and Dual Plant.
					Tons.	Tons.		
Auckland ..	62	35	4	101	61,247	13,335	19,176	1,339
Taranaki ..	19	73	34	126	10,705	36,369	3,226	3,961
Wellington ..	19	49	8	76	9,721	13,072	5,665	1,678
Hawke's Bay ..	10	17	1	28	4,373	3,447	4,007	672
Nelson	6	3	1	10	1,429	547	1,207	685
Marlborough ..	3	2	3	8	646	947	759	191
Westland ..	10	2	..	12	504	19	668	9
Canterbury ..	9	15	2	26	1,243	2,146	4,715	2,022
Otago and Southland	12	77	1	90	1,599	14,781	6,169	3,268
Totals ..	150	273	54	477	91,467	84,763	45,592	13,825

Whey butter was manufactured as a side-line at eighty of the above cheese-factories in 1929-30, the total quantity forwarded for export being 1,133 tons. This is not included in the total amount of 91,467 tons of butter given in the table, which refers to creamery butter only.

In the 1929-30 period there were also operating in the Dominion five milk-powder factories (three whole-milk and two skim-milk plants), six casein-factories, two condensed-milk factories, and one sugar-of-milk factory.



MILKING-SHORTHORN HEIFERS AT RUAKURA FARM OF INSTRUCTION

Some of these two-year-olds are being offered at the Farm's annual sale next month.

WEATHER RECORDS: JUNE, 1930.

Dominion Meteorological Office.

General Notes.

The June just past was the coldest for a number of years. Though the weather was at times stormy, and showery conditions prevailed at many places, rainfall was generally much below normal and there was a large amount of sunshine. Rainfalls in excess of the average were experienced in North Auckland and about Foveaux Strait. At Tauranga, also, largely owing to a fall of 6·45 in. on the 20th, there was an excess. In all other parts there was a considerable deficit. This was most accentuated in Nelson and Marlborough and the interior of the South Island, where much of the weather was beautifully fine. At Nelson it was the driest June on record. The cold weather was accounted for by a marked prevalence of southerly winds during the month. Temperatures were from 1° to 2·5° F. below normal, and frosts were everywhere very numerous and often severe.

The month began with a vigorous cyclone operating on the coast of New South Wales, where severe floods had been caused by continued heavy rains. This main cyclone lost its energy to a large extent before reaching New Zealand, and, passing north of the Dominion on the night of the 3rd, affected our weather comparatively little. Easterly gales blew in North Auckland and short-lived south-easterlies in Cook Strait. This storm was followed by a series of similar ones which lasted until the 7th. They all took a northward track, and, except to produce southerly winds and cold weather, continued to have little influence on the South Island. Heavy rains were recorded between the 3rd and 5th in North Auckland. Puhipuhi Plantation had 13·73 in. during this period, of which 6·35 in. fell on the 4th.

On the 8th another depression of cyclonic form appeared in the Tasman Sea, and, deepening considerably during the next two days, crossed the North Island from Cape Egmont to Napier on the 10th. Rain was fairly general and there were some heavy falls, particularly in Taranaki and the northern and north-western portions of the South Island. There were westerly gales in North Auckland on the 10th during the passage of the centre, and on the following day southerly gales were widespread. Pressure became very high over the Tasman Sea following the passage of the cyclone, while it remained low to the east of New Zealand. Strong southerly winds continued, in consequence, until the 14th, with bitterly cold weather. The gale on the 11th was severe, and slight damage was done. Snow fell on the high country as far north as East Cape, while in Canterbury and Otago it extended to parts of the lowlands. Mount Egmont had the heaviest snowfall for years. Hail and sleet were recorded at many places.

A third period of stormy weather occurred from the 20th to the 25th. A depression which crossed the Dominion on the 20th again assumed cyclonic form. Rains were practically general over the North Island, but more scattered in the South. Particularly heavy falls were recorded in the Auckland Province, the majority receiving over 2 in. The highest registration was 7·06 in. at Okere Falls, near Rotorua, but Tauranga, as already noted, received 6·45 in. and Waihi 5·14 in. There were boisterous westerly winds also in the Auckland, Thames, and East Cape districts on the 20th, slight damage being done. Another spell of strong southerly winds and cold temperatures followed. The 21st was a particularly bitter day, especially in Canterbury, Otago, and Southland. Heavy falls of snow occurred almost everywhere in these provinces, while there were frequent showers of hail or sleet. Snow and hail continued to be experienced in the South at intervals until the 25th. The conditions appear to have been most severe in the district round Gore. A severe thunderstorm occurred in Foveaux Strait during a west-south-westerly gale at 5 a.m. on the 25th.

Although there was an unusual frequency of hail and snowstorms during the month, the accumulation of snow on the ranges does not appear to have been heavy except at a few places

RAINFALLS FOR JUNE, 1930, AT REPRESENTATIVE STATIONS

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
	North Island				
		Inches.		Inches	Inches.
1	Kaitaia ..	8·86	22	2·86	5·53
2	Russell ..	..	..	..	7·15
3	Whangarei	9·38	21	2·56	6·22
4	Auckland	4·29	23	1·86	4·91
5	Hamilton	3·56	15	2·10	5·19
5A	Rotorua	5·06	4	3·27	5·24
6	Kawhia ..	5·06	17	1·10	5·72
7	New Plymouth	3·42	18	0·76	6·14
8	Riversdale, Inglewood	5·09	14	1·44	10·31
9	Whangamomona ..	2·83	9	0·70	7·62
10	Eltham ..	3·87	13	0·75	5·46
11	Tairua ..	6·15	11	4·56	7·38
12	Tauranga	7·87	10	6·45	5·42
13	Maraehako Station, Opotiki	5·40	11	4·04	5·99
14	Gisborne	2·38	14	0·90	5·28
15	Taupo ..	2·22	7	1·11	4·48
16	Napier ..	2·02	10	0·97	3·59
17	Hastings	2·26	10	1·21	3·37
18	Taihape ..	2·37	21	0·32	3·85
19	Masterton	2·49	16	0·73	3·48
20	Patea ..	3·57	16	0·85	4·15
21	Wanganui	2·90	9	0·68	3·19
22	Foxton .	2·17	8	0·70	2·96
23	Wellington (Karori Reservoir)	3·30	12	0·94	4·63
	South Island.				
24	Westport	5·76	15	0·95	8·85
25	Greymouth	4·70	14	0·70	8·27
26	Hokitika	4·81	15	1·13	9·60
27	Ross ..	5·52	14	1·00	9·20
28	Arthur's Pass	4·48	4	1·83	10·12
29	Okuru ..	6·82	15	1·24	10·76
30	Collingwood	..	..	..	11·33
31	Nelson ..	0·63	3	0·42	3·69
32	Spring Creek	0·88	3	0·48	3·01
33	Tophouse	2·60	7	0·93	4·75
34	Hanmer Springs ..	1·96	11	0·82	3·11
35	Highfield, Waiau ..	1·30	7	0·44	2·49
36	Gore Bay	1·53	10	0·45	2·34
37	Christchurch	1·31	12	0·24	2·66
38	Timaru ..	0·64	7	0·22	1·70
39	Lambrook Station, Fairlie ..	0·59	4	0·26	1·91
40	Benmore Station, Clearburn	0·20	5	0·10	1·90
41	Oamaru ..	0·40	7	0·18	2·01
42	Queenstown	1·13	11	0·28	2·46
43	Clyde ..	..	..	..	0·98
44	Dunedin	1·64	15	0·39	3·15
45	Wendon	2·04	13	0·51	2·42
46	Gore ..	4·24	21	0·83	2·82
47	Invercargill	4·92	21	0·55	3·60
48	Puysegur Point ..	7·46	24	1·06	6·58
49	Half-moon Bay ..	7·87	24	1·07	4·51

—*Edward Kidson, Director of Meteorological Services, Wellington, 7/7/30.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

MARE WITH LUMP ON SHOULDER.

"DRAUGHT HORSE," Eltham :—

I have a young draught mare which has developed a large lump on the top of the shoulder on one side. I have no doubt that this is due, in the first place, to the collar not fitting properly. The mare is abnormally big at the top of the shoulders. The ploughman tells me it was caused by a strain or knock. He has been working the mare off and on all the season. The lump does not appear to affect it in any way, but it is quite a size and is hard—in fact, feels almost like bone. Would it be any use putting a blister on the lump to reduce it? The mare works quite well, is very willing, and does her share in the plough team, but the lump is very much in the way of the collar.

The Live-stock Division :—

The first suggestion is that the case is of the nature of fistulous withers. The latter is the result of a deep-seated injury or knock often affecting the spinous processes of the vertebræ in the region of the withers. If of such a nature, the swelling may later burst, leaving a deep fistulous tract down to the seat of injury. Such a condition can only be cured by a radical operation, opening up the tract under aseptic precautions. On the other hand, the swelling may be in the nature of a tumour not uncommon in horses in the region of the shoulder, probably more commonly located at the point of the shoulder. The latter is probably the correct diagnosis in your case, as the swelling is described by you as being of a bony nature. In neither case, however, is it considered that a blister would be effective in reducing the swelling. If a tumour is present, excision of the growth is the most likely procedure. In the meantime, as the mare is working well it would be advisable to have the collar specially chambered and altered to meet the case. When the urgent team-work is over, it would be advisable to have the mare examined by a qualified veterinary surgeon.

LAWN PESTS.

W. NEWLING, Mount Maunganui :—

Will you kindly give us some information how to deal with the brown grass-grub. It is destroying our croquet-lawn, and has also started on the bowling-green.

The Horticulture Division :—

The information supplied is insufficient for definitely identifying the pest attacking your lawns. Among others the "brown grass-grub" may be the white grub or larva of the brown beetle (the chafer beetle) that commonly does great damage to grass on light land by feeding on the roots; or it may be a dark-coloured caterpillar, the larva of a moth that lies in a burrow during the day and comes out to feed on the surface at night. Both of these pests are doing serious damage to mown lawns in many districts. The best treatment for the first-named pest, so far as is known at present, is to maintain the green in strong condition by means of manure and frequent rolling to consolidate the ground and keep the plants vigorous. You might also try an insecticide, such as Jeyes powder or Cliff's insecticide, broadcast on the surface and washed in. These are sold as soil-fumigants, and some users claim that their lawns attacked in this way have been much benefited by the treatment when applied as soon as the damage commenced. For checking the caterpillar a solution of Restar is very effective. Water the lawn during an evening or in dull weather with 6 fluid oz. of Restar well stirred in 5 gallons of water. This dressing should be washed well in with a plentiful supply of water, since it then acts more quickly and is less likely to injure the grass, as it may do otherwise, particularly when applied during strong sunshine.

CONTROL OF FLEAS.

"FARMER," Motu Ora Island, Auckland :—

Please advise me how to get rid of little black fleas in dry soil and about pig-houses. It would require to be something that would not poison young pigs. I have tried lime, sulphur, ashes, disinfectant, and sheep-dip, but without avail.

The Live-stock Division :—

We would advise giving the soil a good dressing with burnt lime ; or you might try spraying the ground with a solution of formalin The strength should be a breakfast-cup of formalin to a kerosene-tin of water. This treatment, of course, would be only of a temporary nature, and the insects would come back again. They apparently do the animals no harm, and an occasional spray of the formalin solution would be beneficial

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DESTROYING PERIWINKLE.

J. H. P., Manaia :—

Kindly advise me of a good and efficacious method of eradicating periwinkle. I have some growing near trees, also some in the open.

The Fields Division :—

Periwinkle is a garden escape which entrenches itself in some soils and is most difficult to eradicate. Probably the best-known method is to grub and burn the refuse, and, if convenient, cultivate and crop the land for a year or two afterwards. If, however, the land is unsuited for cultivation, we would advise the trial spraying by means of a knapsack spray-pump, with a solution of 5 per cent. sodium chlorate (diluted with water). Each time fresh growth shows it should be treated, and two or three sprayings may be necessary. We have had marked success with this specific on a number of weeds, though periwinkle has not been experimented with so far. Sodium chlorate is not poisonous to stock.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 22nd May to 3rd July, 1930, include the following of agricultural interest :—

No. 62975 Milking-machine ; P. H. Sutton, Waihi Plains. No. 62988 : Churn ; F. J. M. Johnston, Sydney, N.S.W. No. 63040 : Sheep drench ; L. W. G. Lee, Canberra, Australia. No. 63172 : Cow-cover ; L. V. Dahl, Palmerston North. No. 63207 : Cooling milk ; J. V. Grantzow, Gorley, Denmark. No. 63959 : Egg-laying recording ; G. Doul, Caithness, Scotland No. 64200 : Seedling box ; G Fear, Wanganui No. 64708 : Treatment of foot-rot ; E. S. Hickey and F. J. Stockman, Opunake. No 64718 . Milking-machine indicator attachment. J. Treloar, Hamilton. No. 62713 : Manure-distributor ; W. H. Franks, Bell Block. No. 62963 : Milking-machine releaser ; J. Treloar, Hamilton. No. 63100 : Spraying-apparatus ; Booth, MacDonald, and Co., Ltd., Christchurch. No. 64456 . Bag for fruit-picker ; Alexander Thomson and Son, Ltd., Dunedin. No. 63576 : Manure-distributor ; G E. Sargent, Netherton. No 64041 : Wire-tying machine ; Gerrard Wire Tying Machines Co. Pty., Ltd , West Melbourne, Victoria. No. 64495 : Milk-storing vat ; E. N. Bevin, Whangarei. No. 64853 : Dipping sheep ; S. V. Wass, Nyngan, N.S.W. No. 62702 . Bail feeder ; E. J. Matthews, Palmerston North. No. 63582 : Chain harrow ; D. Hay and R. Hay, Auckland. No. 64888 : Plough ; R. W. Reid, Alexandra. No. 64935 : Harrow ; H. V. Henrikson, Tatuanui. No. 64936 : Threshing-machine ; H. G. Hall, Evanston, Illinois, U.S A. No. 64984 : Grain-cleaning machine ; A. E. Unstead, Charlton, Victoria.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

CERTIFICATION OF SEED POTATOES.

CERTIFICATES ISSUED ON TUBER INSPECTION, SEASON 1929–30.

FOLLOWING is a list of growers whose crops have been subjected to and have passed the final tuber inspection in connection with the system of Government certification of seed potatoes conducted by the Department of Agriculture, thus qualifying for certificates. The list comprises those crops passed up to the 30th June. Further lists will be published later.

In the May *Journal* was published a list of growers who had received provisional certificates. The acreage and relative cropping-power of each line were also quoted in that list, to which intending purchasers should refer.

Aucklander Short-top (N.Z. Sutton's Supreme).

Weeber Bros., Belfast.
F. Brundell, Kaiapoi
J. Jellie, Russley Road, Fendalton.
W. E. Martin, E. Eyreton R.M.D.
G. Harris, Milford, Temuka
A. J. Rich, Kaiapoi
W. Oakley, Halkett
D. Marshall, Killinchy R.M.D.

Aucklander Tall-top (N.Z. Sutton's Supreme).

Weeber Bros., Belfast.
J. Warren, Russley Road, Fendalton, Christchurch

Epicure.

D. Marshall, Killinchy Rural-mail Delivery
W. Shellock, Rural-mail Delivery, Mead, Rakaia.

Dakota.

H. M. Marshall, Rural-mail Delivery, Weedons.
W. A. McPhail, Rakaia.

Robin Adair.

D. Marshall, Killinchy Rural-mail Delivery.

Majestic.

A. J. Clarke, Rangiora.
C. H. Wilson, Lorneville, Invercargill.

Arran Chief.

G. Jones, "Vale Royal," Halswell

Early Regent.

M. Kelly, 502 Lincoln Road, Halswell

King Edward.

L. King, Rakahouka, Glencoe Rural Delivery, Invercargill.

INTERIM STATISTICS OF LIVE-STOCK, 1929–30.

INTERIM statistics issued by the Census and Statistics Office give the following approximate numbers of live-stock in the Dominion for the 1929–20 season (the final figures for 1928–29 being added in parentheses): Horses, 297,264 (298,986); dairy cows, 1,423,867 (1,371,063); total cattle, 3,720,969 (3,445,790); sheep shorn, 26,927,799 (25,295,560); lambs tailed, 14,823,357 (13,855,958); total sheep at 30th April, 1930, 30,637,390 (29,051,382); pigs, 483,820 (556,732). The detailed interim sheep return is printed elsewhere in this issue.

The New Zealand
Journal of Agriculture.

VOL. 41. WELLINGTON, 20TH AUGUST, 1930. No. 2.

THE GRADING OF MILK FOR CHEESE MANUFACTURE.

H. R. WHITEHEAD, Bacteriologist, Dairy Research Institute (N.Z.), Palmerston North.

THE process of cheese manufacture depends to a large extent on the action of bacteria. They are responsible for the necessary acid-production throughout the actual manufacturing process, and play an essential part in the ripening of cheese. All bacteria do not, however, act in the desired manner. Some produce unclean flavours, and are the cause of other undesirable conditions in both milk and cheese. Hence the cheesemaker prefers to have, as his raw material, milk which contains as few bacteria as possible. Those bacteria which are desirable can be added to the milk in the form of a starter culture, and the absence of undesirable germs in the milk is an insurance against trouble during manufacture and against unclean flavours in the cheese.

Pasteurization was originally introduced as a means of controlling the activities of undesirable bacteria which had gained access to the milk owing to unclean methods of handling. But pasteurization is only a partial corrective, for two reasons: firstly, the bacteria may have already produced chemical changes in the milk; and, secondly, milk, unlike cream, cannot be heated to a temperature sufficiently high to ensure destruction of all bacteria without altering its taste and chemical properties. In a badly contaminated milk there still remains after pasteurization a sufficient number of living organisms to be a potential source of trouble.

Hence if the best-quality cheese is desired it is necessary, despite pasteurization, to insist that the supply of milk shall be as free from bacteria as possible. Human nature being what it is, practically the only way to achieve this end is to institute a system of payment for milk according to its bacteriological quality, as well as for its quality as judged by the senses. The factory-manager already practises a very lenient grading. He rejects milk which is objectionable to the smell or taste. This system must still obtain under any grading system, but in addition some test is necessary which will give an estimate of the number of bacteria in the milk. The present article is a consideration of the various methods of grading and the best methods of applying them.

It should be emphasized at the outset that there is no method which will serve to determine accurately the number of organisms present in a sample of milk. Several methods, however, give estimates which are sufficiently reliable for the purpose of milk-grading. So far as commercial application is concerned, therefore, the main points to be considered are simplicity and cheapness, for it would be quite possible to spend more in carrying out milk-grading than the industry would gain from the improved quality of the final product

There are three methods commonly applied to the determination of bacteriological quality in milk—namely, the direct microscopic count (Breed method), the plate count, and the methylene blue reductase test.

The plate count is carried out by mixing definite small quantities of the milk with a special jelly (agar) in which the bacteria thrive. When the agar is incubated at 37° C. (98° F.) each germ reproduces by dividing, and continues to do so until it has produced millions of its kind, thus forming a colony of bacteria which can be seen by the naked eye. After incubation for two days, the number of colonies is counted, and thus an estimate of the number of bacteria originally present in the milk is made. This method can be dismissed from consideration for the present purpose on account of the expense of its application both in materials and time. The other two methods have both been successfully applied to the examination of milk supplied to cheese-factories, and it is proposed to discuss their relative merits and to indicate how they could be applied on a national scale

THE DIRECT MICROSCOPIC COUNT (BREED METHOD).

Practically the only apparatus needed for carrying out the direct count is a microscope and its accessories. The microscope is costly (£20 to £30), but it has a long life and costs nothing for upkeep. The milk-samples can be taken and the slides prepared on the factory receiving-stage, and the examination can then be carried out at any convenient time. Alternatively, an antiseptic, such as phenol, can be added to the samples as they are taken, and they can then be sent to a central laboratory for examination.

The samples are prepared for examination by spreading $\frac{1}{100}$ of a cubic centimetre (about $\frac{1}{3000}$ of an ounce) of the milk over an area of one square centimetre on a microscope slide. After the milk has been dried on the slide the fat is removed with a suitable solvent, and the film is treated with a blue stain which colours the bacteria so that they can be easily seen under the microscope. The stained milk smear is then examined under a microscope which has been adjusted so that the area seen in each field is known. This area is usually $\frac{1}{3000}$ sq. cm., or one three-thousandth of the total area of the milk smear. The bacteria seen in thirty successive fields are now counted and the average number per field, is found. It is now possible to calculate the number of bacteria in 1 c.c of the original milk. For instance, suppose the average number per field is five, the number of bacteria in the whole milk smear is $5 \times 3{,}000 = 15{,}000$. The milk smear was prepared from $\frac{1}{100}$ c.c. of milk; therefore the number of bacteria in 1 c.c. of milk $= 15{,}000 \times 100 = 1{,}500{,}000$. The slide can be kept for future reference if required. It is thus possible to demonstrate to a farmer the condition of his milk on any particular day.

A disadvantage of the method is that it is not possible to distinguish between dead and living organisms, nor is it possible to predict how rapidly the bacteria will multiply in the milk. Some of them may be of slow growth and hence of comparatively little importance, but the Breed method does not permit of any discrimination. The method has the advantage that an experienced observer can sometimes recognize certain bacteria by their shape and arrangement, and hence can deduce the sources from which the milk became contaminated. Emphasis must, however, be laid on the fact that *considerable* experience is necessary before reliable deductions can be made in this way.

With regard to the technique of the examination, it is obvious that it takes an appreciable time to count the bacteria seen in thirty fields, and that it would hardly be possible for one person to grade fifty milk-samples in a day. For this reason some workers have adopted a modification of the method whereby an estimate of the number of bacteria is made after a rapid examination of the milk smear under the microscope Using this modification, it is said to be possible to examine two hundred samples in a day. In the following discussion it will be assumed that this modification is to be used.

THE METHYLENE BLUE REDUCTASE TEST.

The methylene blue reductase test is still more simple. The most expensive part of the apparatus is a water bath fitted with a thermostat, which costs £6 to £10. Samples of milk are taken on the factory receiving-stage. A definite quantity of each milk (10 c.c., 20 c.c., or 40 c.c.) is measured into a clean dry test-tube. One cubic centimetre of methylene-blue solution is added, and the tubes are incubated in the water bath at 38°–40° C. (100°–104° F.). The dye solution is of such a strength that in the mixture of milk and methylene blue there is one part of dye in 200,000 parts of fluid. The tubes are examined from time to time, and the period required for decolorization or bleaching of colour is noted for each sample. This time varies with the number of bacteria present in the milk-sample. A milk of poor sanitary quality, containing large numbers of bacteria, will rapidly bleach the dye, whereas a milk containing few bacteria will remain blue for seven hours or longer. In practice, of course, it is necessary to examine the tubes only at those times which are the limits of the different grades of milk.

The method suffers from the disadvantage that all organisms have not the same decolorizing power, and consequently the reduction time is no more than a rough measure of the number of germs present in the milk. This is one reason why it is impossible to obtain more than a very imperfect correlation between this test and the direct count. On the other hand, only the living bacteria can affect the methylene blue, and their rate of growth and effects one upon another are factors which are reflected in the result of the test. Furthermore, the test has a definite end-point about which there can be little disagreement, whereas an estimation by the modified direct count introduces a personal factor which can easily lead to disagreement between the results of different observers. Especially is this the case where bacteria exist in clumps and chains in the milk, for the germs may be very unevenly distributed in the stained smear, and it is then difficult to make a reliable estimate by the microscopic method.

Extension of Reductase Test; Fermentation Test.

The extension of the reductase test into the so-called fermentation test (by incubation of the sample for twenty-four hours) gives still more information about the types of bacteria present in a milk-sample, and it is possible to detect the presence of germs capable of producing undesirable flavours. Deductions made from observation of the physical properties of the curd produced are less reliable, and it is doubtful whether any material advantage can be gained by taking the type of curd into account in grading a series of samples of milk. For instance, a milk containing very few bacteria rarely gives a smooth curd, although the number of undesirable organisms present is much too small to cause trouble in cheese manufacture. A heavily contaminated milk, on the other hand, often gives a smooth curd in spite of the probability that it contains many organisms capable of exerting an adverse influence on cheese.

The Wisconsin curd-test, in which a curd is produced by the addition of rennet to the milk, is a much more reliable means of determining the potentialities of a given milk in the cheesemaking process, but it would hardly be possible to use it regularly to grade the milk of all suppliers. It should be reserved as a supplementary test in special cases.

Practical Methods capable of General Application.

The fact that there is not an accurate correlation between the results of the reductase test and of the direct count is really of little moment, for it is obvious that the application of either test, combined with differential payments, will stimulate an improvement in the sanitary quality of the milk. The methylene-blue test has probably a slight advantage in that it is carried out under conditions which more closely approximate to those obtaining in the cheese-vat, but the main factor in any choice between the two methods must be the practicability of application on a national scale.

Whichever method be chosen, it will be impossible under present conditions to grade the milk-supplies of a given factory daily, and probably three tests of each supplier's milk in a ten-day period will be the maximum practicable. Some factories might find it impossible to carry out the grading more than once in each period. No more than three grades are necessary, and the writer is of the opinion that, at the outset, two grades would serve the purpose and at the same time simplify matters. For instance, if the reductase test is to be used, three hours might be taken as the dividing-line between the two grades. It would, of course, be valuable to make a note of those samples which decolorized in less than one hour, so that the farm dairy instructor could visit the worst farms as soon as possible; but all samples which decolorized within three hours should be relegated to the lower grade. It is relatively easy to produce milk with a reduction time of more than three hours, and yet there are at present many suppliers whose milk gives a result well below this figure. Probably the standard could profitably be altered during the colder months, when five hours might be adopted as a standard. According to the results of several workers, these reduction times would correspond roughly to counts of 8 to 10 millions and 2 to 3 millions per cubic centimetre respectively by the direct count, so it is evident that the standard set would not be particularly high.

It should be emphasized at this point that, whatever the system of grading, the factory-manager must always have the power to lower the grade of any milk which is objectionable to the senses and yet gives no indication of inferior quality in the test. It is evident that there are objectionable qualities, such as feed flavours, which no bacteriological test will detect. On the assumption that the grading is carried out three times during a ten-day period, it is suggested that a supplier would be paid on a first-grade basis if two of his samples were graded first , if two of his samples were graded second he would be paid on that basis for the whole ten days.

The next point to be considered is whether the grading tests should be carried out by factory employees or by some independent grader. It would probably inspire more confidence in the minds of suppliers if the second method were adopted ; but in this event grading would be a more costly procedure, for one tester could hardly deal with more than three or four factories. Here, again, the method to be used must be taken into consideration. The methylene-blue test could best be conducted by some one in each factory, since it is necessary to examine the tubes at intervals (depending on the standard times adopted). If the direct count were used, on the other hand, an independent tester could prepare slides from the milk on the receiving-stage and then take them to a central laboratory for examination. Alternatively, he could have a small laboratory fitted up in a motor-van. It would be quite possible for some one on the factory staff to carry out the direct count ; but the examination would consume most of his time during the day, and it would be difficult in many factories to find a place suitable for microscopic work.

A consideration of all these points leads one to the conclusion that the most practical way of grading milk at the present time is to adopt the methylene-blue test as a standard procedure, and to delegate one employee at each factory to carry out the test. Possibly the employee who at present checks the standardization in many factories could look after the milk-grading also. In instances where anomalous results were obtained with the reductase test, and where there would appear to be peculiar conditions on some farm, it would be possible to have a more detailed examination of the milk carried out in a laboratory with a view to deducing the cause of the trouble.

Procedure recommended for conducting the Methylene-blue Test.

APPARATUS REQUIRED.

(1) *Metal Water Bath with some Arrangement for maintaining a Constant Temperature of 38°–40° C. (100°–104° F.).*—A spirit-lamp or gas-flame may be used to heat the water bath, but an electric heating-element controlled by a thermostat is better. An electrically heated bath capable of holding forty-eight tubes can be obtained from Messrs. Chas. Hearson and Co. for about £10. The water bath should on no account be fitted with glass sides, as erroneous results may be obtained due to a decolorizing action of sunlight on methylene blue in milk.

(2) *Tubes.*—These should be fairly strong, and should be of such a size that 20 c.c. of fluid fills them to a point about 1½ in. from the top,

so that the contents can be easily mixed by inversion of the tubes. Tubes with a length of about 6 in. and a diameter of ⅝ in. are suitable. The tubes should have a sand-blasted area on the side, where the supplier's number can be written

(3) *Measures.*—Some apparatus for measuring 20 c.c. of each milk-sample is necessary. A small dipper holding exactly 20 c c. is the most convenient device. A 1 c.c. pipette is needed for distributing methylene-blue solution into the test-tubes.

(4) *Methylene-blue Solution.*—The correct solution contains one part of dye in 10,000 parts of water. 1 c.c. of this solution added to 20 c.c. of milk will give a dilution of methylene blue in milk of 1 in 200,000. The dye solution can be prepared either from Blauenfeldt and Tvede's tablets or from powdered methylene blue of guaranteed purity. Powder containing 89 per cent. of methylene blue can be obtained from Arthur H. Thomas Co., Philadelphia, U S.A. The tablets give a solution containing 1 part of dye in 10,000 parts of solution when one tablet is dissolved in 400 c.c. of water. Distilled water (condensed water from a pasteurizer) should be used for making the solution. The solution is stable for a considerable time, but in order to avoid the use of solution contaminated with traces of water from the pipette it is perhaps advisable to make up a stock solution of 1 in 2,500. Portions of this can be diluted with three parts of distilled water at fortnightly intervals to give a dilution of 1 in 10,000

THE ACTUAL TEST.

The milk-samples are collected on the receiving-stage by dipping 20 c.c. of milk from the weighing-vat into tubes which have recently been cleaned and dried. The supplier's number is marked on each tube. The dipper should be washed in warm water after each sample is taken. Alternatively, larger samples of milk may be taken in clean bottles, the bottles being cooled in water until all the samples have been collected. The quantities required for the test can then be taken from the bottles.

Where the samples are placed directly in the tubes, the tubes should be either cooled in water or the methylene blue should be added and the test started on batches collected within half an hour or one hour. The underlying idea with either system is to avoid the unfairness which would result if certain samples were allowed to remain uncooled for some time before starting the test. When all the samples, or a batch of samples, have been filled into tubes, 1 c.c. of methylene-blue solution is added to each sample. *The methylene blue should on no account be placed in the tubes before the milk, since the dye stains glass very readily and it is almost impossible to remove the stain.*

The contents of each tube are mixed by closing the mouth with a finger and inverting it. The finger should be wiped before the next tube is inverted, in order to avoid the mixture of one milk with another. All the tubes are then placed in the water bath and the time is noted. An examination is made at the requisite times, and those samples which show a return to the normal colour of milk are noted as reduced within the particular time-limit. Slight traces of blue persisting at the top or bottom of a sample may be ignored.

Samples occasionally show a patchy decolorization. In these instances the tube may be rotated gently in the hands, and is to be regarded as decolorized if the blue is not distinct enough to be detected after the contents have been mixed in this way. *In no case is it permissible to invert tubes and shake the contents after the first admixture of the blue, for it is possible to restore the blue colour to any decolorized sample by shaking with air.*

CERTIFICATION OF SEED POTATOES.

REVIEW OF OPERATIONS FOR SEASON 1929–30.

J. H. CLARIDGE, B.Agr., Assistant in Agronomy, Department of Agriculture, Palmerston North.

SEED-POTATO certification in New Zealand was established by the Department of Agriculture in 1927, and for the benefit of new readers a brief outline of the scheme is given before proceeding with the season's review.

The object aimed at in certification is to place before merchants and growers information which will enable them to obtain seed potatoes which are true to name, reasonably free from tuber-borne diseases, and capable of producing a satisfactory yield. Applications are invited from growers, and a sample of 150 tubers is collected from the seed they intend to plant. These samples are grown by the Department of Agriculture under uniform conditions so that the growth and yield of the different samples of a variety may be compared one with another.

During January or February the grower's crop is subjected to a first field inspection. When the shaws have commenced to die down the second field inspection is undertaken, and the seed-tuber produce of the crop is again inspected when bagged and ready for sale. If a crop passes the necessary standards, the grower is issued with sufficient certification tags to enable him to attach one tag to each bag of certified seed he has for sale, and at the end of the season he is issued with a certificate.

During the past season potato-certification has been in operation throughout the Dominion, though the great majority of the crops have been grown in the South Island. The following figures give the number of applications for certification received from the different districts :—

Otago and Southland	65
Canterbury and Marlborough	310
Manawatu and Hawke's Bay	5
Auckland	28
Total	408

These figures show a marked increase over that for the 1928–29 season, when a total of 180 applications was received from the South Island. (There was no potato-certification in the North Island in that season.)

CROPPING-POWER.

In the review of operations for 1928–29, published in the *Journal* for June, 1929, particular stress was laid on the importance of the cropping-power of various lines. It is desired to again emphasize the importance of this characteristic; in fact, so much weight is accorded to it that this year, in conjunction with the list of growers whose crops had been provisionally certified, the cropping-power of each line was given. (See *Journal* for May last, page 354.) In this way a farmer can know the relative cropping-value of the seed he is purchasing compared with other lines of the same variety.

Table 1 indicates the cropping-powers of the various lines in the certification trials. The term "cropping-power" may perhaps need explanation again. This figure is obtained by adding together the yield of table tubers and half the yield of seed tubers, and converting the results into tons per acre. Thus, while in these figures "seed" is given a certain value in the crop it is only half that given to "table," which seems more desirable than either placing seed at the same value as table, or, on the other hand, giving it no value whatsoever.

Table 1.—Cropping-power of Lines of Potatoes in Certification Trials, Season 1929–30

Variety.	Number of Lines.	Range of Cropping-power in Tons per Acre.	Average Cropping-power in Tons per Acre.
Dakota	107	11·6 – 1·7	6·7
Iron Duke	7	10·8 – 3·1	6·2
Aucklander Short-top	63	14·4 – 3·1	7·6
Aucklander Tall-top	19	14·0 – 3·3	9·1
Arran Chief	30	10·6 – 2·2	6·3
King Edward	21	8·8 – 4·5	7·2
Bresee's Prolific	15	6·8 – 3·7	5·2
Epicure	15	9·7 – 0·5	3·8
Up-to-date	16	11·5 – 2·2	5·9
Field Marshal	3	10·5 – 5·3	8·3
Majestic	11	8·0 – 1·9	5·2
Northern Star	4	9·4 – 6·0	7·8
Endurance	4	13·5 – 4·6	8·8
Jersey Bennes	6	6·4 – 1·6	4·1
Early Regent	3	3·6 – 2·7	3·1
Great Scot	3	5·5 – 2·2	3·6
Robin Adair	2	6·5 – 5·9	6·2
Golden Wonder	2	6·1 – 3·8	4·9
Reading Russet	2	9·1 – 7·9	8·5
Shamrock II	2	7·3 – 6·1	6·7
Maori Chief	2	9·3 – 9·2	9·2
Early Rose	1	11·5	..
North Downs	1	4·1	..
Kerr's Pink	1	3·0	..
Sharpe's Express	1	1·4	..
Witchill	1	0·8	..
Eclipse	1	1·6	..
Arran Victory	1	5·5	..
Cliff's Kidney	1	3·4	..
Brownell's Beauty	1	10·4	..

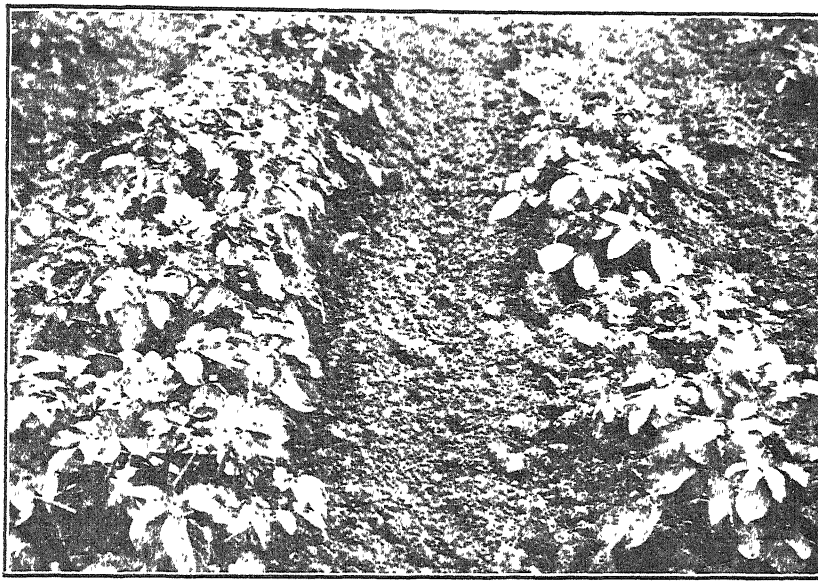
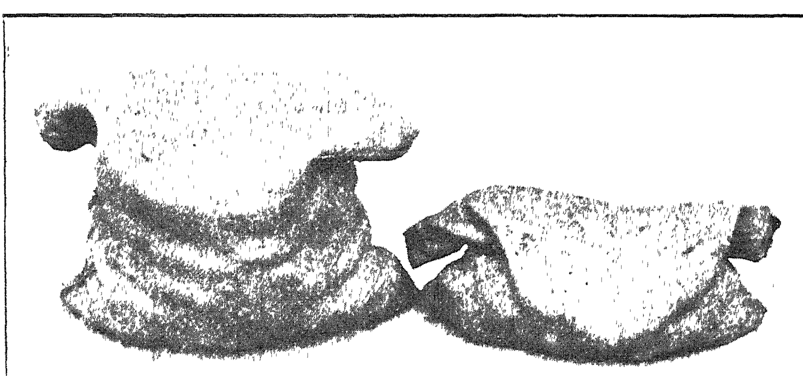


FIG I VARIATION IN VIGOUR, DUE TO MOSAIC INFECTION, IN TWO LINES OF EPICURE POTATOES ENTERED FOR CERTIFICATION TRIAL.



9·7 tons per acre. 3·2 tons per acre.

FIG. 2. RESPECTIVE YIELDS FROM THE TWO LINES OF EPICURE SHOWN IN FIG. I.

[*Photos by J. Claridge.*

The trials in the past season were much elaborated in order to determine the cropping-powers with greater accuracy. This entailed the planting of ten small plots (ten tubers each) at the local trial area (Gore, Ashburton, or Palmerston North, as the case might be), and four similar plots at the central trial area at Palmerston North. Thus for each crop entered in certification there were fourteen small plots under close observation and trial. In addition, the plots were so arranged that each was growing immediately alongside a similar sized plot of a standard line for comparison of yield, this same standard line being used throughout all the trials.

It is essential to remember that even now the trials are not absolutely accurate; in fact, differences of half a ton are not reliable, those of 1 ton give only an indication, while it takes differences of at least 1½ tons to be really reliable. Even so, in glancing down the yields obtained from any one variety it is easily seen that some crops are definitely better than others, and it is only the higher-yielding lines which are being certified.

No cropping-powers of the lines from the Auckland district are being published. This is on account of the system of double cropping and resultant uneven maturity in the seed planted in December affecting the yields. While certain crops could be picked out as being definitely better than certain others, it would be unfair to attempt to place the crops in any order of merit on the results obtained. It was decided, therefore, to omit all yields of these lines from the list. Suffice it to say that the lines which have been entered from the Pukekohe district are, on the average, of a much higher standard of cropping-power than lines of the same varieties entered from other districts.

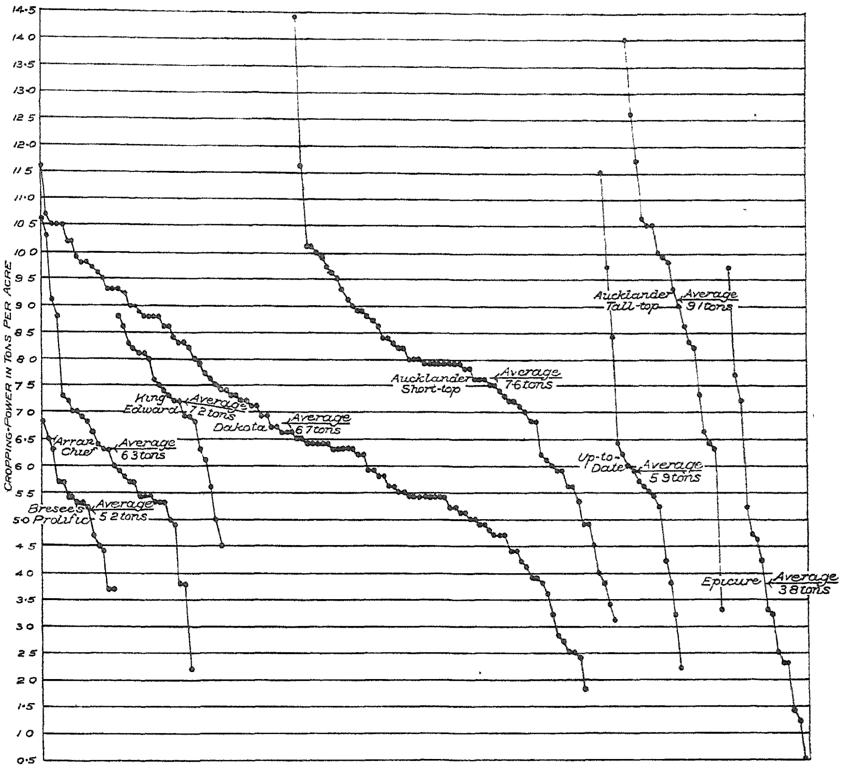
Range of Yield.

Graph 1 represents the range of yield of several of the more important varieties. In connection with these it is interesting to note that there is a tendency for the lines of any one variety to be divided into three groups: (1) A few outstanding crops, (2) the bulk of crops round the average, and (3) a few very poor crops.

The Aucklander Tall-top variety has again given the highest average yield, with the averages of the other main-crop varieties more or less in a group, as was seen last year.

The importance of what one might term "pedigree" in regard to seed potatoes is stressed when it is mentioned that in the Dakota variety of the thirty-four highest crops in the list, yielding from 11·6 to 7·6 tons per acre, no fewer than twenty-four can be traced back with certainty over the last two seasons to one grower. Further, there is no seed which can be traced to this grower which is recorded below this point in the list. The variation between the highest and the lowest yield in these twenty-four crops is due largely to selection on the part of purchasing growers on the one hand and the planting of second-grade seed on the other.

To further stress the importance of pedigree, taking the same variety, two lines traced back to another grower yielded 5·5 tons and



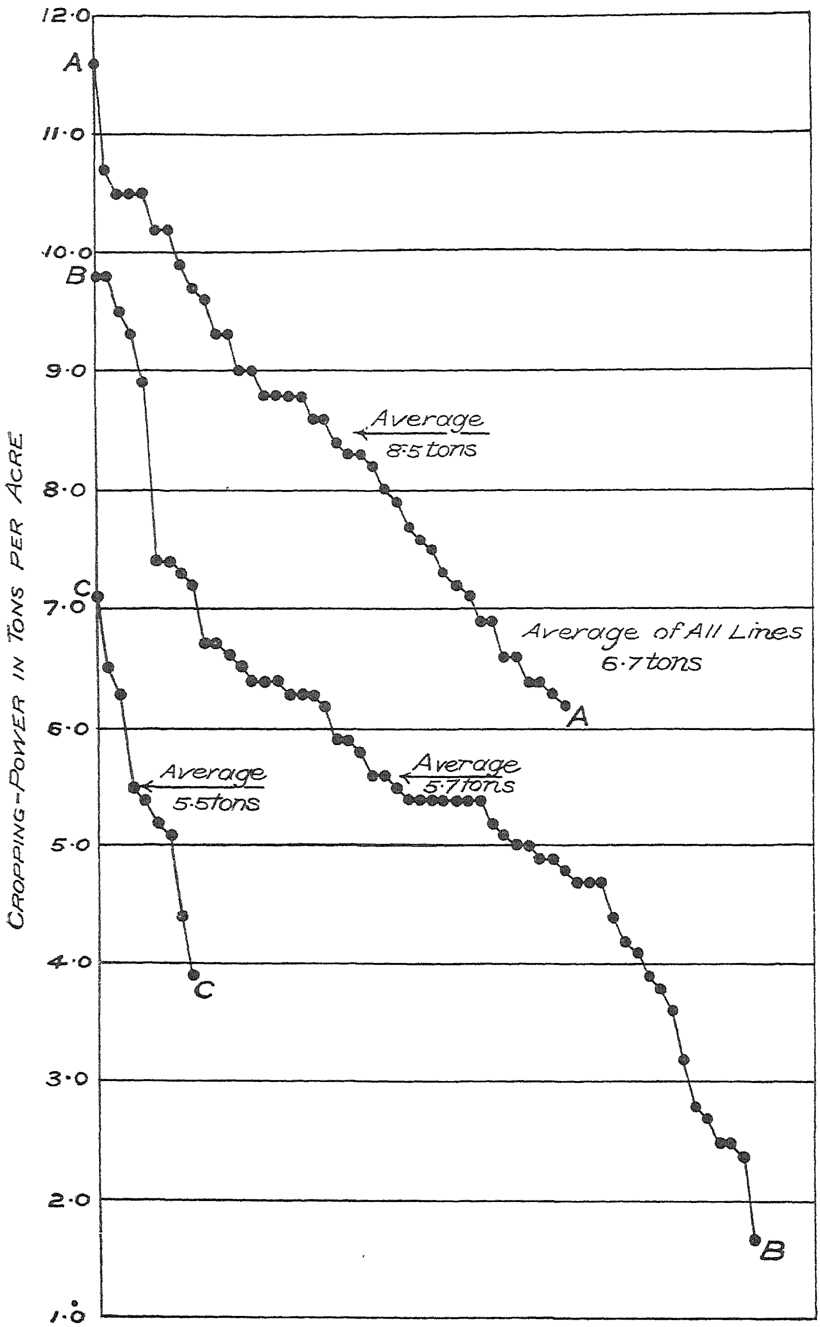
GRAPH I. RANGE IN CROPPING-POWER SHOWN BY LINES OF THE MORE IMPORTANT POTATO VARIETIES UNDER TRIAL, SEASON 1929–30.

5·4 tons respectively, while five lines traced to a third grower yielded from 5·4 to 7·5 tons. Other and similar examples could also be drawn to illustrate the same point.

The advantage of planting certified over uncertified seed is shown in Graph 2, where the lines of Dakota have been divided into three groups as follows: (1) Those lines which were provisionally certified last year and were again under trial this year; (2) those lines not previously under trial; (3) those lines under trial and rejected last year and again under trial this year. (NOTE.—One or two of those under the last category were passed for cropping-power in the previous year, but were rejected on account of eelworm or powdery scab.)

No explanation is required to show the advantage of using certified seed. A grower may purchase a line of uncertified seed equal to the best certified line, but, on the other hand, one can easily see from the graph that should he purchase uncertified he is more likely to strike a line which yields below even the lowest yielding certified line.

It is interesting to record that for the third year in succession the premier position in both Dakota and Up-to-date has been occupied by the same grower—an outstanding performance. Two other growers have topped the list in Aucklander Tall-top and Epicure respectively



GRAPH 2. DAKOTA YIELDS, SHOWING DIFFERENCES BETWEEN CERTIFIED AND UNCERTIFIED SEED.

A. Crops provisionally certified in 1928–29 and again entered in 1929–30.
B Crops entered in 1929–30, but not entered previously.

for the second season. The Ausklander Short-top list is headed by an outstanding line which was not under trial in the preceding year. In the past season's trials it was observed as being particularly vigorous right throughout the growing-time. Arran Chief this year shows a much bigger range than last year. In this variety nearly half the lines were so badly mixed with Northern Star that no account could be taken of their cropping-power.

CORRELATION BETWEEN VIRUS DISEASE AND CROPPING-POWER.

It has been asked many times by farmers if there is any relationship between incidence of virus disease and the resultant cropping-power. This year the reports on the inspections of ninety-seven lines of Dakotas were examined, and the incidence of virus disease in the trial plots was compared with the yields of the plots. The figures in Table 2 show conclusively that as the percentage of virus-infected plants increases so the yield decreases.

Table 2.—Correlation between Virus Infection and Yield.

(The lines examined are grouped according to yield.)

Number of Lines in each Group.	Limits of Yield in each Group in Tons per Acre of Cropping-power.	Average Percentage of Virus Infection for the Lines of each Group.
1	11·5 – 11·9	7
Nil	11·0 – 11·4	..
4	10·5 – 10·9	16
2	10·0 – 10·4	16
6	9·5 – 9·9	18
5	9·0 – 9·4	17
6	8·5 – 8·9	18
5	8·0 – 8·4	19
4	7·5 – 7·9	20
7	7·0 – 7·4	22
9	6·5 – 6·9	23
11	6·0 – 6·4	33
6	5·5 – 5·9	37
11	5·0 – 5·4	43
6	4·5 – 4·9	43
4	4·0 – 4·4	45
3	3·5 – 3·9	62
1	3·0 – 3·4	61
4	2·5 – 2·9	68
1	2·0 – 2·4	76
1	1·5 – 1·9	94

GRADING OF CERTIFIED SEED.

Owing to the number of complaints coming to hand regarding uneven grading of certified seed an attempt was made during the 1928–29 season to control this to some extent. The method adopted for the 1929–30 season's grading embodied slight alterations. Full particulars will be found in an article published in the last April issue of the *Journal*, or may be obtained from any Instructor in Agriculture.

Reasons for Rejection.

It has been very difficult to obtain figures which illustrate satisfactorily the relative importance of the various "reasons for rejection of lines." For example, a crop with 10 per cent. of rogues and 50 per cent. of leaf-roll is rejected on account of rogues, and the leaf-roll is not taken into consideration; also, such crop is not subjected to inspection for eelworm, powdery scab, &c.

Table 3.—Reasons for Rejection of Lines.

Variety.	1. Number of Lines entered.	2. Percentage rejected for Rogues.	3. Number inspected for Virus and Cropping-power.	4. Percentage rejected for Virus and Deficient Cropping-power.	5. Number inspected for Eelworm, Powdery Scab, &c.	6. Percentage rejected for Eelworm, Powdery Scab, &c.	7. Number issued with Provisional Certificates.	8. Percentage of Total issued with Provisional Certificates.
		Per Cent.		Per Cent.		Per Cent.		Per Cent.
Dakota	97	20·0	77	55·8	34	20·6	27	27·8
Auckland Short-top ..	61	26·2	45	37·8	28	7·2	26	42·7
Arran Chief	54	61·2	21	76·3	5	40·0	3	5·5
King Edward	19	10·5	17	41·2	10	10·0	9	47·5
Aucklander Tall-top ..	18	16·7	15	33·3	10	20·0	8	44·5
Up-to-date	16	12·5	14	78·7	3	33·3	2	12·5
Bresee's Prolific	14	14·3	12	41·7	7	..	7	50·0
Epicure	13	..	13	53·8	7	..	6	46·2
Majestic	9	..	9	77·8	2	..	2	22·2
Northern Star (South Island)	4	..	4	75·0	1	..	1	25·0
Total of all varieties ..	363	23·5	279	54·2	128	14·8	109	30·0

In Table 3 an attempt has been made to overcome this difficulty, with regard to the more important varieties, and the following explanations amplifying the brief headings are here added:—

Column 1 represents the number of crops inspected for rogues.

Column 2 gives the percentage rejected on account of rogues.

Column 3 represents the number of crops which passed the "rogue" inspection and were subjected to an inspection for virus disease and test for cropping-power.

Column 4 gives the percentage of those inspected which were rejected on account of virus disease and deficient cropping-power.

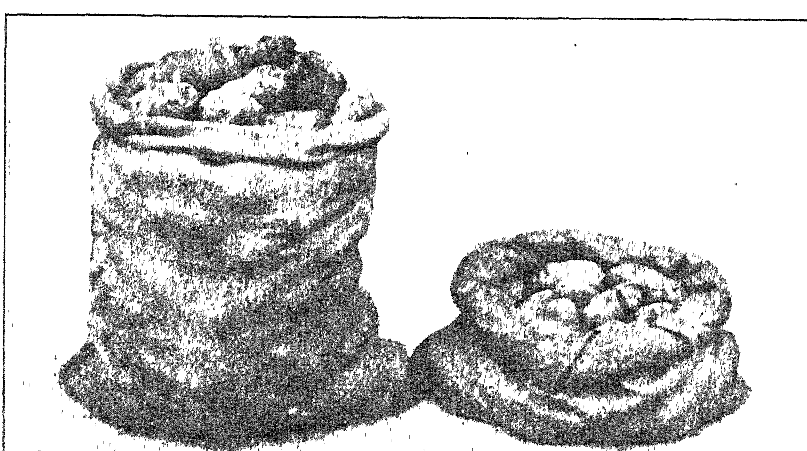
Column 5 represents the number of crops which passed in the virus inspection and cropping-power test.

Column 6 gives the percentage of those inspected for powdery scab, eelworm, &c., which were rejected for these diseases.

Column 7 represents the number of crops which passed all these inspections and have been provisionally certified.

Column 8 gives the percentage of crops passed compared with the original number inspected as in column 1.

FIG. 3. TWO LINES OF DAKOTA POTATO UNDER CERTIFICATION TRIAL.
On left, a healthy line; on right, line heavily infected with leaf-roll.



11·6 tons per acre. 3 tons per acre.

FIG. 4. YIELDS FROM THE TWO LINES OF DAKOTA SHOWN IN FIG. I.

[*Photos by J. Claridge.*

Table 4 shows the number of lines inspected in the less common varieties and reasons for rejection of these. It is interesting to note the number of these which may be classed as "seedsmen's" lines and are often grown in private gardens which have been rejected owing to their high virus percentage or low cropping-power.

Table 4.—Results of Inspection of Less Common Varieties.

Variety.	Number of Crops entered.	Number rejected on account of			Number provisionally certified.
		Rogues.	Virus and Deficient Cropping-power.	Eelworm, Powdery Scab, &c.	
Iron Duke	4	2	1	..	1
Jersey Bennes ..	4	..	2	2	..
Endurance	4	..	2	1	1
Early Regent ..	3	..	1	..	2
Great Scot ..	4	..	3	..	1
Brownell's Beauty ..	1	..	..	..	1
Robin Adair ..	1	..	..	..	1
Golden Wonder ..	2	..	1	..	1
Maori Chief.. ..	2	1	..	..	1
Field Marshal ..	1	..	..	..	1
Early Rose	1	..	..	1	..
White Beauty of Hebron	1	1	..	..	..
North Downs ..	1	..	..	..	1
Kerr's Pink.. ..	1	..	1	..	..
Sharpe's Express ..	1	..	1	..	..
Witchill	1	..	1	..	..
Eclipse	1	..	1	..	..
Arran Victory ..	1	..	1	..	..

AREAS PROVISIONALLY CERTIFIED

Provisional certificates are issued on the results of the field inspections and sample trial reports, with a view to giving the grower some definite information as to his line, and this certificate is in effect a statement that, provided his graded seed is up to the standard indicated in the field inspections, he will be issued with the necessary tags and full certificate.

A list of all provisionally certified crops was published in the *Journal* for May last, and lists of final certificates in the July issue and present number. Intending purchasers of certified seed would be well advised to refer to these.

In Table 5 is given a list of crops passed provisionally, and the areas of these crops during the three seasons in which the certification system has been operating.

Of the 363 crops inspected this past season 104 were from seed provisionally certified last year and the remainder from seed either not under trial or rejected last year. One hundred and eight crops gained provisional certificates this year, and of these sixty-two had been similarly certified last year. That is to say, 60 per cent. of crops provisionally certified last year and entered again this year have been again provisionally certified, while only 18 per cent. of those crops not provisionally certified last year have been given provisional certificates this year.

Table 5.—Number of Crops of each Variety provisionally certified, Seasons 1927–28, 1928–29, and 1929–30.

Variety.	Number of Crops.			Area (in Acres).		
	1927–28.	1928–29.	1929–30.	1927–28.	1928–29.	1929–30.
Dakota	11	12	27	121	81	132
Aucklander Short-top ..	7	11	26	75	67	96
Aucklander Tall-top ..	5	4	8	30	17	56
King Edward.. ..	..	1	9	..	2	25
Bresee's Prolific ..	10	4	7	106	54	78
Arran Chief	4	9	3	36	54	6
Up-to-date	3	5	2	13	20	3
Epicure	5	6	5	13	15	29
Endurance	1	3	1	1	4	3
Early Regent ..	1	2	2	35	23	4
Majestic	..	2	2	..	6	11
Iron Duke	..	..	1	..	..	12
Great Scot	..	2	1	..	2	4
Golden Wonder ..	..	2	1	..	4	1
Field Marshal ..	..	1	1	..	7	5
Robin Adair	2	..	1	6	..	3
Brownell's Beauty ..	..	1	1	..	1	3
Northern Star ..	1	1	8	35	12	17
Maori Chief	..	..	1	..	..	2
North Downs ..	..	..	1	..	..	2
Totals	50	66	108	471	369	491
Average areas ..	.	..	..	9·4	5·5	4·6

The inspection work in connection with potato-certification, and upon which this review is based, has been carried out by the Instructors in the districts concerned—mainly Messrs. C. C. Leitch (Christchurch), J. O. Wallace (Dunedin), and J. E. Bell (Auckland), and the assistance of these officers in supplying data for this article is here acknowledged.

EXPERIMENTS IN FRUIT-SETTING OF DELICIOUS APPLE.

DURING the past two years experiments have been carried out in Otago by the Horticulture Division with the object of determining the treatment which would cause strong-growing Delicious trees on rich alluvial soil to set their fruit satisfactorily. Several series of tests—manurial and pruning—were carried out. Reporting on the work, Mr. W. K. Dallas states that the treatment which gave the best results was a normal pruning, combined with the application of sulphate of potash at the rate of 2 lb. per tree in the month of August in each of the two years. The trees set a crop which averaged fourteen loose petrol-cases per tree, as compared with an average of five loose cases in the other plots. The pruning consisted of a judicious cutting-out of leaders where it was considered there were too many in the trees, with the object of allowing more sunlight into the centre. The lateral growth was thinned out, and the remaining laterals shortened back from 14 in. to 18 in. in length.

MINERAL CONTENT OF PASTURES RESEARCH.

SOME NOTES ON THE WORK IN 1929–30.

(Concluded.)

B. C. ASTON, Chief Chemist, Department of Agriculture.

Malnutrition on certain Poverty Bay Back-country Pastures on Coarse Pumice Soils.

Additional samples were obtained from this area during the past year in midsummer, when the pasture presumably would be at the lowest content of phosphoric acid. The samples gave evidence that they were comparatively free from contaminating soil, and afforded evidence of the low iron content comparable with what is found in the "bush-sick" pumice lands. With the pure uncontaminated samples there appeared to be evidence of correlation between the iron content of the pastures and the degree of healthiness of the stock grazed. Pastures showing the relatively higher iron content produce healthy sheep, and those showing the lower iron content produce sheep showing evidence of deficiency disease. A large-scale manuring trial with phosphates is now in progress, and should the sheep go sick on this land there will be no doubt of the trouble being the same as "bush sickness."

It will be noted from the accompanying analyses (Tables 1 and 2) that the only samples of pure red clover analysed exhibited the same low iron content comparable with that of the bush-sick lands. It should be noted also that previous samples of pasture collected in October (see *Journal* for July, 1929, p. 26) showed no deficiency of phosphoric acid, and therefore one is justified in assuming that the low phosphoric-acid content at the end of January has a seasonal cause.

All the samples here dealt with were collected on 23rd and 24th January, 1930, and consisted of seven ordinary pastures (Nos. 6708–14), one red clover (No. 2064), and one white clover (No. 74).

Table 1.—Summary of Poverty Bay Back-country Pasture Analyses.

Results expressed as percentages on matter dried at 105° C.

Pasture Samples.	Ash.	Soluble Ash.	Silica (SiO_2).	Iron (Fe)	Alumina (Al_2O_3).	Phosphoric Acid (P_2O_5).	Calcic Oxide (CaO).
Average of seven samples	10·93	6·36	4·57	0·0088	0·02	0·60	0·65
Highest ..	12·63	9·24	5·92	0·0130	0·03	0·96	0·85
Lowest ..	10·05	4·34	3·15	0·0067	0·02	0·42	0·51

Pasture Samples.	Magnesia (MgO).	Manganese (Mn).	Chlorine (Cl).	Soda (Na_2O).	Potash (K_2O).	Nitrogen (N).
Average of seven samples	0·37	0·0156	0·94	0·11	3·26	2·98
Highest	0·51	0·0290	1·39	0·17	5·17	3·92
Lowest	0·27	0·0094	0·67	0·04	2·08	2·18

[*Analysts: Misses Young, Strand, and Mason.*

The samples were remarkably free from earthy contamination, as shown by the low alumina content. The iron figures may therefore be taken as showing the iron that is actually present in the plant tissues.

Table 2.—Results of Individual Poverty Bay Samples.

Expressed as percentages on matter dried at 105° C

Lab No.	Locality.	Remarks.	Iron (Fe).	Manganese (Mn).*	Phosphoric (P_2O_5)	Calcic Oxide (CaO).
6708	Rakauroa	Lambs go sick in this unmanured paddock	0·0070	0·011	0·43	0·55
6709	,,	More healthy than No 6708	0·0130	0·009	0·44	0·69
6710	Matawai	Unmanured. Lambs die here	0·0081	0·013	0·42	0·51
6711	,,	Same as No 6710, but manured with phosphates	0·0085	0·013	0·66	0·69
6712	,,	Healthy; new burn; unmanured	0·0100	0·017	0·76	0·60
6713	,,	Moderately sick ..	0·0086	0·017	0·74	0·85
6714	,,	One of the most sick paddocks in the district. Unimproved	0 0067	0 029	0·47	0·69
2064	,,	Red clover on sick country, phosphated	0·0065	0·0069	0·64	3·33
74	Rakauroa	White clover on sick country, phosphated	0·0120	0 0052	0·78	1·61

An important point to notice is that clovers (supplying calcium) are present in fair quantity in the country, although lime is not shown in high quantity by analysis. This is just one of those cases where it is difficult to include in the samples an adequate amount of white or red clover, although the sheep probably secure a fair proportion.

Wairarapa District.

The collection of samples of pasture from this phosphate-deficient district has been continued, and the results of the analyses are supplying interesting information on seasonal and other data. The district is a very large one, in which, while it contains the most phosphate-deficient pastures yet met with in New Zealand, giving rise to "Waihi disease" in cattle, certain areas afford soils of great fertility and pasture of high nutrient value. Clovers are in no area generally deficient, and the calcium content is as a rule good, and in cases even high. Insufficient uncontaminated samples have been received to determine the natural iron content, but in cases there is evidence of excess of manganese which is often found with iron deficiency.

Waihi disease is due to deficiency of phosphorus in the diet of the cattle. This trouble presents the simplest deficiency disease which occurs in New Zealand, the evidence being convincing and continuous from the soil, the pasture, and the animal. The chain of reasoning one seeks to establish in all other deficiency cases is in this complete and satisfactory. Briefly, (1) the soil is found to be deficient in available and total phosphoric acid by chemical analysis; (2) treatment of

the soil with phosphates banishes the disease in cattle thereon depastured, provided the climatic conditions allow the ready absorption of the phosphates by the pasture; (3) the untreated pasture on chemical analysis gives a very low result for the phosphorus content; (4) on top-dressing with phosphates the phosphorus content of the grazed pasture (not necessarily the hay) immediately rises if the rainfall is sufficient; (5) the animal shows a train of definite symptoms suggesting lack of phosphorus in the diet, swollen joints and lameness in the cattle affected being prominent; (6) treating the animal with (*a*) phosphate lick, (*b*) superphosphate in the drinking-water or drenching with syrup of phosphate of iron, or (*c*) grazing on top-dressed pasture cures the disease.

Previous chemical analyses of soils and pastures will be found in this *Journal* for October, 1928, p. 242, and August, 1929, p. 79. The results of analysis of pasture-samples collected in the four seasons of the past year are now available for seven different farms representing six different areas in the Wairarapa. Most of the samples are badly contaminated by earthy matter, as shown by the high alumina content. The iron and manganese are probably much too high from this cause. Cow pastures in North Wairarapa are represented by those of Mauriceville and Hamua farms, those in South Wairarapa by Featherston and Dalefield farms. Sheep pastures are represented by two Masterton farms and a Martinborough farm. In all of these the phosphoric-acid content increases to the maximum in the spring, falling with the summer, and reaching the lowest figure in the autumn. The calcium is lowest in the winter and tends to increase with the progress of the seasons, giving the maximum figures in the autumn. Nitrogen in every case attains its maximum content in the spring, falling to the lowest in the autumn.

Table 3.—Average Results of Analyses of Wairarapa Pastures in 1929–30.

Expressed as percentages on the matter dried at 105° C.

Location and Class of Pasture.	Season	Phosphoric Acid (P_2O_5).	Calcic Oxide (CaO).	Chlorine (Cl).	Nitrogen (N).
North Wairarapa cow pastures (Mauriceville, Hamua)	Winter (1929) ..	0·78	1·16	0·94	2·93
	Spring (1929) ..	0·93	1·68	1·05	4·13
	Summer (1929–30)	0·74	1·65	1·24	3·49
	Autumn (1930)	0·60	1·87	1·11	3·08
South Wairarapa cow pastures (Featherston, Dalefield)	Winter (1929) ..	0·94	0·74	1·15	3·70
	Spring (1929) ..	0·96	0·99	1·38	4·10
	Summer (1929–30)	0·82	1·00	1·24	4·00
	Autumn (1930)	0·71	1·08	1·18	3·25
Mid-Wairarapa sheep pastures (Masterton), medium to good	Winter (1929) ..	0·67	0·57	0·93	2·45
	Spring (1929) ..	1·09	0·75	1·33	4·95
	Summer (1929–30)	0·77	0·69	1·14	3·27
	Autumn (1930)	0·62	0·85	1·00	2·47
South Wairarapa sheep pastures (Martinborough), poor to medium	Winter (1929) ..	0·66	0·55	0·99	3·23
	Spring (1929) ..	0·64	0·69	0·87	2·69
	Summer (1929–30)	0·60	0·56	0·99	2·76
	Autumn (1930)	0·49	0·79	0·90	2·10

[*Analyst: P H. Sykes.*

NOTE.—One sample was analysed from each locality every season, and the mean of results given for each group. At Featherston two samples were collected from one farm. All samples were analysed in duplicate.

In addition to those shown in Table 3, a number of farms in various localities yielded samples for three seasons of the year, no summer samples having been collected. In all of those in which figures for winter, spring, and autumn samples are available the autumn samples show the lowest phosphoric-acid content, while the calcium usually rises in the autumn. Farms which previously showed an unusually low phosphoric-acid content in the pasture have again exhibited the same deficiency, thus confirming the first finding published, that some Wairarapa pastures contain the least phosphoric acid of any met with in New Zealand. Following are the results from the Atea (Hukanui) and Kaituna, together with those from two Martinborough farms, which also show decidedly low figures in phosphoric acid and calcium :—

Atea.	Phosphoric Acid (P_2O_5). Per Cent.	Lime (CaO). Per Cent.	*Kaituna.*	Phosphoric Acid (P_2O_5). Per Cent.	Lime (CaO). Per Cent.
Winter ..	.. 0·29	0·45	Winter	.. 0·24	0·44
Summer	.. 0·30	0·63	Summer	.. 0·41	0·63
Autumn	.. 0·29	0·71	Autumn	.. 0·35	0·86

Martinborough.

FARM A.	Phosphoric Acid (P_2O_5). Per Cent.	Lime (CaO). Per Cent.	FARM B	Phosphoric Acid (P_2O_5). Per Cent.	Lime (CaO). Per Cent.
Summer	.. 0·62	0·42	Spring	.. 0·44	0·40
Autumn	.. 0·18	0·37	Summer	.. 0·39	0·40

An interesting fact elicited in connection with the analysis of the Wairarapa pastures is that the percentage of carbon dioxide (carbonic-acid gas) found in the pasture ash calculated on the dry matter is roughly proportional to the clover percentage. It may therefore prove of considerable assistance in assessing the influence of the clover in the composition of the pasture, and even render a botanical analysis unnecessary.

Although leaching is one of the most prominent faults in a coarse air-borne pumice soil, it is noteworthy that Waihi disease never develops on such soils.

Middle Waikato District.

Sixteen samples from typical dairy-farms were collected in the spring of 1929 by Mr. R. E. R. Grimmett in association with the local veterinary officer of the Department. The samples were analysed fully and form an interesting accession to our knowledge of the composition of spring pastures which have been liberally phosphated. The samples were nearly all highly contaminated with soil, and thus the iron and possibly the iodine content determination may be faulty in representing more than the amount of mineral matter present in the tissue of the pasture ; therefore the figures for iron and alumina are not given in Table 4. It will be seen that the Waikato pastures are richer than the Taranaki pastures in nitrogen.

Table 4.—Analyses of Waikato Spring Pastures. (September, 1929.)

Results expressed as percentages on matter dried at 105° C.

Samples.	Ash.	Crude Silica.	Soluble Ash	Phosphoric Acid (P_2O_5).	Lime (CaO).
Average of sixteen ..	10·16	2·20	7·97	0·86	0·91
Highest	11·06	2·77	9·15	0·99	1·15
Lowest	9·13	1·47	7·12	0·76	0·57

Table 4—continued

Samples.	Magnesia (MgO)	Manganese (Mn)	Chlorine (Cl).	Sodic Oxide (Na_2O)	Potassic Oxide (K_2O).	Nitrogen (N).
Average of sixteen	0·39	0·020	1·08	0·33	3·66	4·55
Highest ..	0·46	0·035	1·46	0·61	4·51	5·21
Lowest ..	0·29	0·007	0·92	0·23	2·67	3·92

The average of six determinations for iodine was 41·8 gammas (maximum 65·1, minimum 27·6).

Temporary Sterility.

It was agreed (see Annual Report of Scientific and Industrial Research Department for 1929, p. 21) that certain work should be done in connection with the analysis of pastures in districts where temporary sterility in dairy cattle was a serious menace to the dairy industry. This investigation has been carried out during the past year in the Taranaki and Waikato districts. A large number of samples have been collected by Mr. Grimmett in close co-operation with the veterinary officers of the Department of Agriculture. No decided correlation between mineral content and incidence of temporary sterility has been detected, but the work is being carried on and will provide useful data regarding the average composition of the typical dairying pastures. The cost of this investigation was borne entirely by the Department of Agriculture. Altogether fifty-two samples were collected, and the analyses, performed in duplicate, for calcium, phosphoric acid, and nitrogen have been completed in every case. In addition nine samples were analysed fully.

In the Taranaki samples collected in the spring of 1929 the results for phosphoric acid may be possibly rather lower than usual, due to the abnormally droughty period, when only one-half the usual rainfall was recorded. Whether this is a correct deduction will be ascertained from the analysis of samples collected in the coming spring of 1930.

Table 5 in the next section shows the mean results obtained from forty-eight samples averaged (omitting extraordinarily low samples due to low fertility or abnormally poor pasture). The rainfall figures showing the abnormal season are given in Table 6.

Taranaki Dairy-pastures Investigation.

This is the first work of its kind and scope done in New Zealand. The samples were obtained by an expert sampler from portions of pasture actually bitten by the stock, and the samples may thus be taken to represent what the cows are actually eating. The whole district of Taranaki, which is of all others in New Zealand, predominantly dairying-country, was carefully traversed by the sampler in company with the Veterinarian in charge of the district. Tables 5 and 7 show how far the work has gone at present and the results obtained in one season—the spring (September) of 1929. The pastures generally were well supplied with clovers, and rye-grass was a prominent constituent of most of them. Further samples were obtained in the autumn (March, 1930), and the results are presented in Table 8.

Table 5.—Analyses of Taranaki Dairy-pasture Samples collected in Spring of 1929.

Results (except botanical analyses) expressed as percentages on matter dried at 105° C.

Samples.	Phosphoric Acid.	Lime.	Nitrogen.	Botanical Analyses		
				Grasses.	Legumes.	Weeds.
Group 1: West of Mount Egmont (Oakura, Oaonui, Okato, Tumahu, Opunake, Omata).						
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Average of thirteen	0·85	1·10	4·12	69	24	7
Maximum ..	1·01	1·35	4·93	90	39	13
Minimum ..	[illegible]	0·71	3·39	54	7	3
Group 2: East of Mount Egmont (Stratford, Inglewood, Toko, Egmont Village, Midhirst, Tariki).						
Average of fifteen	0·92	1·28	4·26	72	21	7
Maximum ..	1·18	1·62	4·92	92	46	11
Minimum ..	0·73	0·88	3·82	44	5	3
Group 3: North of Mount Egmont (New Plymouth, Lepperton, Brixton, Huirangi, Waitara, Bell Block, Westown, Fitzroy).						
Average of thirteen	0·86	1·11	4·09	70	24	6
Maximum ..	1·08	1·29	5·35	87	41	9
Minimum ..	0·71	0·85	3·62	53	7	2
Excluded from average (three samples)—						
New Plymouth	0·53	1·09	3·42	..	..	..
Bell Block ..	0·50	0·83	2·87	..	..	..
,, ..	0·62	0·92	3·54	..	..	..
Group 4: North of Waitara (Uruti, Urenui, Waitoitoi, Pukearuhe) (papa country, littoral ironsand, volcanic loam).						
Average of seven	0·89	0·85	4·34	79	17	4
Maximum ..	1·03	1·05	5·11	85	23	6
Minimum ..	0·75	0·69	3·68	72	12	2

NOTE.—Groups 1, 2, and 3 are soils from basic volcanic rocks from Mount Egmont.

Table 6.—Rainfall Record for Spring of 1929 compared with previous Readings.

Period.	New Plymouth.	Lepperton.	Tariki Hydro.	Inglewood.	Riversdale, Inglewood.	Stratford.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Total for August, September, and October, 1929	9·98	12·29	16·42	15·40	16·20	14·89
Average for August, September, and October, 1926, 1927, 1928	19·96	27·12	30·76	31·76	33·65	32·03

In addition to the foregoing partial analyses ten samples of pasture had been collected from all parts of the district in April, 1929, including Bell Block, Westown, Oakura, Oaonui, Okato, New Plymouth, Lepperton, Tikorangi, and Uruti. These samples were analysed more fully and gave results as presented in Table 7.

Table 7.—Analyses of Taranaki Pasture Samples collected in April, 1929.

Results expressed as percentages on the matter dried at 105° C.

—	Ash.	Silica (SiO_2).	Soluble Ash.	Phosphoric Acid (P_2O_5).	Lime (CaO).	Magnesia (MgO).
Mean ..	9·29	2·27	7·02	0·63	1·27	0·60
Highest ..	10·59	2·87	8·87	0·83	1·80	0·69
Lowest ..	7·83	1·72	5·84	0·47	0·94	0·50

—	Manganese (Mn).	Chlorine (Cl).	Sodic Oxide (Na_2O).	Potassic Oxide (K_2O).	Nitrogen (N).
Mean ..	0·015	1·27	0·65	2·12	3·68
Highest ..	0·038	1·60	1·06	3·06	4·23
Lowest ..	0·009	0·95	0·45	1·26	2·72

Table 8.—Analyses of Taranaki Dairy-pasture Samples collected in Autumn of 1930

Results (except botanical analyses) are expressed as percentages on the matter dried at 105° C.

Samples.	Phosphoric Acid.	Lime.	Nitrogen.	Botanical Analyses.		
				Grasses.	Legumes.	Weeds.
Group 1: West of Mount Egmont.						
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Average of eleven..	0·62	1·10	3·08	76	16	8
Maximum ..	0·80	1·46	3·98	95	35	14
Minimum ..	0·46	0·62	2·29	55	3	2
(Three samples less from Oaonui, two of which were previously included in average.)						
Group 2: East of Mount Egmont.						
Average of fifteen..	0·71	1·29	3·30	70	19	11
Maximum ..	0·92	1·66	3·92	94	38	21
Minimum ..	0·54	0·90	2·77	51	2	1
Group 3: North of Mount Egmont.						
Average of twelve	0·61	1·36	3·04	73	17	10
Maximum ..	0·77	1·92	3·58	84	34	21
Minimum ..	0·44	0·95	2·23	52	10	3
(No sample from Tikorangi.)						
Excluded from average (three samples)—						
New Plymouth..	0·51	1·28	2·94	57	21	22
Bell Block ..	0·47	1·25	2·52	75	8	17
,, ..	0·41	1·33	2·24	75	11	14
Group 4: North of Waitara.						
Average of seven ..	0·75	1·06	3·29	80	13	7
Maximum ..	1·11	1·59	4·20	95	27	13
Minimum ..	0·48	0·66	2·35	69	2	2

[*Analysts. A. Sim, and Misses Strand and Mason.*

Table 8 shows the results of analysis of samples collected in the autumn of 1930 (March). The samples were taken from the same farms and same paddocks as the spring samples, except that certain farms were omitted in the autumn. These latter are noted after the respective group in the table.

Iodine Deficiency.

An interesting case of iodine-deficient land has been discovered in a low-lying area near Pembroke, Lake Wanaka, Otago. The soil and pasture proved on analysis to be low in iodine. Lambs were born with enlarged thyroids, and the history of the area is that stock, although grazed on top-dressed pasture, make every effort to break bounds in order to escape, it is thought, from the iodine-deficient pasture to other areas which are not deficient.

Feeding iodine as potassium iodide, recommended by this Department, apparently causes a cessation of the desire to escape from the paddocks. The matter is discussed in an article published in this *Journal* for April, 1930, where the veterinary, chemical, and agricultural aspects are dealt with by Messrs. Hopkirk, Dayus, and Grimmett, and by Miss Simpson, who carried out the iodine determinations.

Considerable interest is being displayed by the farming community on the subject of iodine feeding to domestic stock, and there is danger that too much may be expected of a substance which must be fed in very small doses, and which may prove an unnecessary burden on the farmer. Probably the best advice that can be given to farmers on average healthy pasture is to try an experiment on a small number of animals before embarking on a general iodine treatment.

How this can best be done will depend on the class of animal and the facilities offering. The treatment of poultry presents no special difficulty, the dosing of the drinking-water being a simple and efficient method of distributing the iodine ration. In a herd of milking-cows, keeping certain cows to certain bails until each has had a lick daily would be a fairly simple method. For sheep and store cattle the regulation of the supply to certain selected animals is more difficult, but should not prove insuperable.

The method of trial and error is better than any amount of theorizing and is the only method one can be sure about in *average* cases. Analysis of soils and pastures can be most misleading with regard to iodine when viewed in the light of the limited knowledge about iodine content. In *exceptional* cases where there is evidence of symptoms suggesting iodine deficiency—such as enlarged thyroid glands (goitres in the neck), hairlessness in young animals, or the birth of monsters—there will be little doubt in the mind of the local officer as to advising a general treatment with iodine of the whole flock or herd.

Central Otago Pastures.

Analyses of a number of pasture samples collected in the spring (October) of 1929, in connection with lamb mortality known as "pulpy kidney" have been made and compiled. These analyses do not lend themselves to any form of condensed statement. There appears to be a wide range of variation in the results. That mineral nutrients in the

pasture should be low in this arid and frosty district, especially in early spring, is perhaps to be expected, in spite of the soil being well supplied with plant-food. No general deficiency of any necessary element which would contribute towards the mortality can be definitely alleged, and caution is necessary when comparing this pasture with that found in humid climates. In the arid area the green pasture will be much drier, and the sheep will presumably consume a greater portion of dry matter In fact, they will be consuming something akin to hay as regards the water content, and hence a greater proportion of dry and mineral matter per day than the same sheep would consume in the humid areas.

The ash, crude silica, soluble ash, iron, alumina, phosphoric acid, lime, magnesia, manganese, chlorine, iodine, soda, potash, and nitrogen were determined in thirty-two samples of Otago and Southland pastures. In a number the sulphur was determined, and this proved to be lower than normal. A deficiency of sodium and chlorine was also found in some samples. This work is to be continued, and at the writer's suggestion experimental licks containing sulphur will be used in the areas badly affected with " pulpy kidney."

Summary.

The practical results of the year's work in connection with the Empire Marketing Board's grant for research into deficiencies in New Zealand pastures may be summarized as follows:—

Mairoa " Dopiness " in Sheep.—The intensive investigation in connection with the lime status of the soils of Mairoa and adjacent districts has proved conclusively that the *fine* volcanic soils are suffering from a widespread and severe calcium deficiency bad enough to stigmatize as " calcium starvation." Experiments with sheep support the theory that calcium compounds must form the greater part of any system of top-dressing designed to overcome the disease.

Bush Sickness, the name by which the progressive anæmia in ruminants occurring on *coarse* volcanic soils is known, is completely cured by iron treatment of the animal. This cure, however, was nullified by the cattle eating ragwort, which is rapidly spreading throughout affected districts It has been proved at Mamaku that the ragwort menace may be successfully fought by chemical means and by short-time stocking with sheep, which are not affected by the ragwort to the same extent as cattle, this (sheep-grazing) being a very old remedy. Citrate, which used to be imported by the hundredweight, has now to be brought in by the ton to combat bush sickness, and is sold at cost price (2s. 6d. per pound) to the farmers. It may be roughly stated that 1 lb. will keep one cattle beast healthy for one year.

A series of soil experiments has now been in operation for two years with a view to test the effect of green-manuring, always held to be a method of soil-improvement which would convert bush-sick into healthy country. This is fundamental work on soil-improvement and is being undertaken without any reference to economic possibilities. Successful crops of blue lupin have been turned under on the very worst and red clover on the best of bush-sick soils. The results will not be available for a considerable time, seeing that it takes normally six to nine months for a cattle beast to show signs of the bush sickness. The extension of the bush-sick area to the pumice country at the back

of Poverty Bay may be expected In fact, wherever large areas of coarse pumice soils are encountered without adjacent finer types suitable for change paddocks it may be expected that bush sickness will occur.

Taranaki and Waikato dairy pastures have been systematically examined to ascertain whether correlation could be established between pasture composition and temporary sterility The samples analysed from all types of soil will prove of considerable assistance in fixing standards for typical North Island dairy pastures

Wairarapa pastures are providing most interesting information regarding the seasonal effect on the mineral content. Well-marked phosphate deficiency is shown in some of the poorer pastures, with evidence of disease in stock, mineral supplements feeding and top-dressing experiments have been instituted

Iodine deficiency has been definitely proved to be affecting stock in two widely separated areas in the South Island—the flat areas near Lake Wanaka, and in the Ahaura Valley, Grey County. Other areas, in the North Island, are at present under suspicion.

Cawthron Institute Results.—The foregoing are the chief lines of work undertaken by the Department of Agriculture. In addition, work at the Cawthron Institute bearing on deficiency diseases is being continued. In the Moutere Hills area, Nelson, the most important results achieved have been the cure, on lime-phosphate deficient soil and pasture, of ruminants evidently suffering from deficiency disease, by bone-meal and other licks. Cattle, particularly cows in milk and young stock, eat the bone-meal greedily, and great improvement in the health of the stock has resulted In the case of sheep considerable quantities of bone-meal have been eaten by ewes in the winter and early spring, but more difficulty has been experienced in estimating the value of the lick. The chief deficiencies reported are calcium and phosphorus, but there also appears to be an unknown factor in the Moutere Hills' pasture which causes xanthin calculi to form in the kidneys—a symptom not hitherto observed in any other deficient locality in New Zealand. Seasonal differences account for great changes in the composition of the Nelson pastures, but the peak of quality, as with Wairarapa pastures, occurs in the spring growth, and the lowest quality is reached with the autumn and winter growth.

In concluding these notes it should be stated that the samples of pasture were collected in the field by the method of Godden, which is that specified to be used in connection with the Empire Marketing Board's work. For the sheep pastures it has been customary to select only bitten portions of the green and growing pasture. There have been cases, however, in very dry seasons where the pasture is not growing, having obviously been killed quickly while green by the drought. As this was the sole food for the sheep, it had to be taken as a normal pasture in one instance.

Much credit is due to the staff at the Department's Chemical Laboratory, Wellington, for their efforts during the year in coping with the increased number of samples received, especially Messrs. F. T. Leighton and R. E. R. Grimmett, Analysts, P. H. Sykes, and F. B. Thompson, also to Misses Simpson, Strand, Young, and Mason for well-sustained work.

BLACK DISCOLORATION IN ANNATTO-COLOURED CHEESE.

INVESTIGATION AT WALLACEVILLE LABORATORY.

G. F. V. MORGAN, N.D.A., N.D.D., Dairy Bacteriologist, Department of Agriculture.

A NUMBER of samples have been forwarded to the Wallaceville Laboratory for investigation into the cause of two types of discoloration which were prevalent in certain lines of cheese made during the past season.

One type is that of a dark-grey or muddy nature, sometimes found in close-textured portions of coloured cheese. Again, the same type of discoloured portion appearing in the neighbourhood of open slits in which luxuriant growths of moulds are frequently found, and which have been observed to spread along the sides of cracks that have developed after the cheese has been cut to expose further discoloured portions. Lastly, a discoloration in the nature of a partial bleaching of the curd.

This last type of discoloration will not be dealt with fully in the present report, as further investigation into the causes and conditions required for the bleaching are still being carried out. It may, however, be mentioned that in some cases the bleaching and dark discoloration have occurred together, with evidence that would seem to point to the fact that the bleaching preceded the final darkening. The bleaching nearly always occurs in the neighbourhood of cracks in the body of the cheese. The matter here presented is by way of a progress report, and has yet to be fully demonstrated in experimental cheese manufacture which is under way.

The first specimens of cheese to be examined showed the presence of a muddy discoloration in the neighbourhood of cracks, and also in isolated close portions of the curd, which, however, in a number of cases showed signs of probable crack development. A number of samples of the latter discoloured portions were taken for microscopic examination. These were first of all dissolved by ether, washed, and treated with ammonia, centrifuged, and the precipitated casein examined. This method of treatment gave very clear slides for examination, free from fat and coarse debris. Two types of microscopic field were seen: (1) Showing predominance of yeasts and the presence of considerable numbers of fairly long, thin, non-sporulating rods; (2) a similar field showing a predominance of the rod, with a considerable number of yeasts present. This latter type of field was by far the commonest. The results of this microscopic examination were fully borne out by the plating method on Sabaraud's agar for yeasts and ordinary nutrient agar for bacteria—in fact, both media gave similar results.

Further samples were at this time received showing a muddy discoloration in the neighbourhood of large cracks spreading through the body of the cheese. This discoloration as it spread into the cheese changed to a definite bleaching, and terminated sometimes as far as 2 in. from the crack itself. The surface nearest the crack showed a very deep, almost

black, discoloration to the depth of about $\frac{1}{8}$ in. This was mainly due to the pigment produced in the mycelium of the mould. Below this the muddy-grey discoloration commenced and spread well below the depth of the mycelial growth, terminating as a bleaching 2 in. and sometimes slightly more from the original crack.

FIG. 1. MICROPHOTO OF PROTEUS VULGARE (TYPE) ISOLATED FROM DARK DISCOLOURED PORTIONS OF ANNATTO-COLOURED CHEESE.

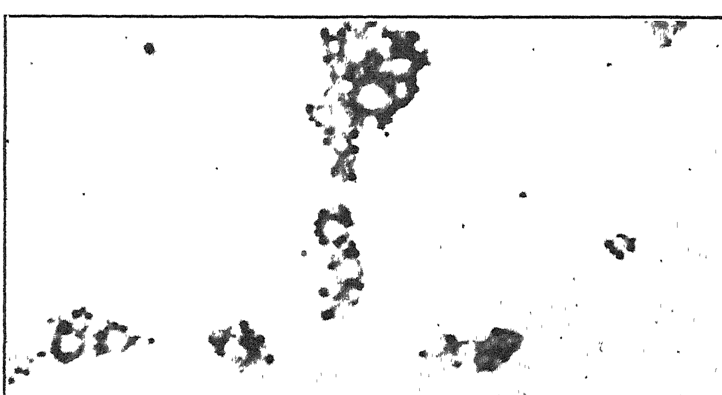


FIG. 2. MICROPHOTO OF YEAST ISOLATED FROM DARK PATCHES, BUT PREDOMINANT IN BLEACHED AREAS.

These cheese-samples were cut under specially sterile conditions giving cut surfaces that showed the discoloured layers to the best advantage; samples were taken from the top (dark discoloured portion)

and from the bottom (bleached area). These samples were examined both microscopically and by the plating method with selected media. The following results were obtained:—

Samples from Top or Dark Discoloured Layer.

Cultures.	Microscopic Examination
Moulds present in considerable number (*Penicillia*)	Fragments of mould mycelium
Large yeast colonies, about fifteen per plate	Yeasts.
Small to pin-point colonies of yeasts rods, the rods predominating	Rods predominant.

Samples from Bleached Portions.

Cultures.	Microscopic Examination.
Moulds absent	Moulds absent
Yeasts forming small colonies apparently in pure culture	Yeast predominant; rods occasional.

At this stage of the investigation pure cultures were isolated of the predominant organism, including the rod, the yeast, and the mould. These organisms appeared in the discoloured portions in pure culture as far as the microscopic and the plate-culture methods can determine.

Classification of Pure Cultures.

Mould—One of the *Penicillium* group.

Rod—Probably *Proteus vulgare*. Characteristics: Gram negative, actively motile, pleomorphic, weak acidity in lactose media; thin, grey, translucent, and spreading on agar; gelatine liquefied, lead acetate turned brown by the production of sulphuretted hydrogen.

Yeast—Classification not determined; spore formation rapid, with the production of false mycelial growth.

The predominance of a rod of the *Proteus* type in the discoloured portions of annatto-coloured cheese, together with its capability of sulphuretted hydrogen production drew attention to the possibility of lead being present in the cheese. (A similar trouble has already been investigated in Britain by Professor Leitch, of Kilmarnock, who found lead to be present in cheeses showing this dark discoloration, and traced the cause to annatto which had been stored in red-leaded drums. The examination for the presence of lead was carried out in this case by a micro-analytical method.)

A micro-analytical method published by L. T. Fairhall, in the *Journal of Biological Chemistry*, 1923, for the determination of lead was adopted at Wallaceville. This is known as Behren's and Kley's triple nitrite test. Samples of the discoloured portions of the cheese under examination, samples of annatto by which the cheese was coloured, and samples of normal-coloured cheese as a control, were ashed. The ash was then treated with distilled water and the solution made just acid to methyl orange by the addition of hydrochloric acid. A drop of 2 per cent. copper acetate was added and the copper precipitated as a sulphide by the addition of sulphuretted hydrogen. (The precipitation of the copper sulphide brings down with it the colloidal lead sulphide.) The precipitate was then separated by centrifuging, washed repeatedly, and finally dissolved in dilute nitric acid and 4 per cent. sodium-acetate solution. A drop of the resulting liquid was then evaporated on a microscope slide, chilled, and a triple nitrite procured by the addition of 10 per cent. acetic acid and a small crystal of potassium nitrate. At this stage the triple nitrite appeared in the liquid on the slide in the form of small square black or dark-red crystals.

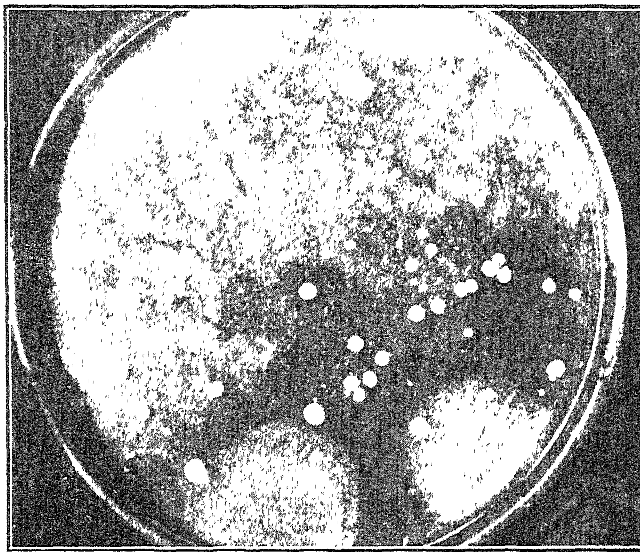


FIG. 3. PLATE CULTURE FROM DARK AREAS.

Large colonies—yeasts (type present only in small numbers) ; pin-point and small colonies—yeasts and rods.

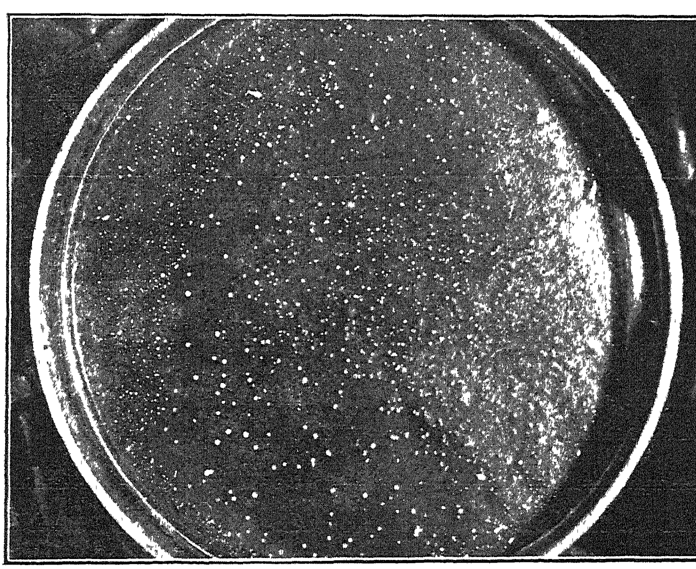


FIG. 4. SHAKE CULTURE FROM BLEACHED PORTION OF CHEESE: YEASTS IN ALMOST PURE CULTURE.

The test gave the following results with the samples of cheese already mentioned. The discoloured portion showed the presence of the black lead crystals at the rate of one or two per microscopic field. The ash from the annatto showed a considerable number of these black crystals per field. The control sample of normal-coloured cheese gave a blank under the microscope.

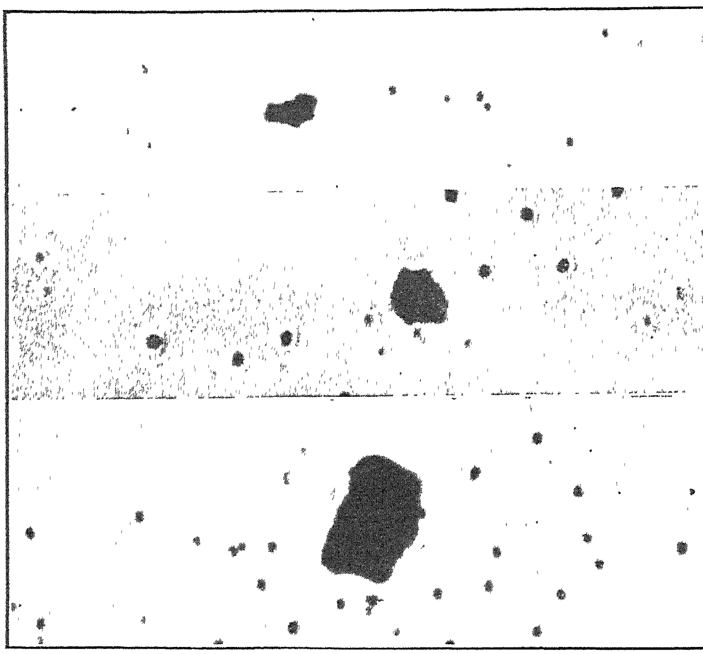


FIG. 5. BLACK TRIPLE NITRITE CRYSTALS SEEN UNDER THE MICROSCOPE IN MASSES.

At bottom, large mass against the side of which may be seen the square outlines of individual crystals.

It may here be added that after the lead had been found present in the ash of the annatto in such quantities by the microscopic test an ordinary qualitative test was applied to the residue of untreated ash and gave a positive result. The test was checked as far as possible at every stage, and a blank control was also carried out to check the purity of the reagents used.

The finding of lead in the cheese and lead in excess in the ash of the annatto, together with the isolation of organisms of the *Proteus* group, seem to give fairly conclusive evidence of the cause of the dark discoloration. Further experiments, however, were tried to demonstrate the effect of the organisms found present in the discoloured portions of cheese in conjunction with lead added to annattoed milk agar.

For the purpose of this experiment, 250 c.c. of milk were sterilized in a 300 c.c. flask and 0·05 per cent. of a solution of lead acetate added. At the same time 2 grammes of powdered agar were dissolved by boiling in 15 c.c. water, forming a viscous solution, capable, however, of being poured. When the milk was sterile and the agar in solution annatto was added to the milk it approximated the colour of annatto-coloured cheese. The agar was then quickly added, thoroughly shaken, and distributed in the body of the still hot milk. The whole was kept shaken till the plates were ready for pouring. This method gave even, homogenous plates similar to an annattoed curd, and is the outcome of a number of trials of various means of obtaining satisfactory milk plates. The only disadvantage of this method is that the plates are rather soft compared with ordinary agar, but they are quite suitable for use even when streak cultures are required.

Cultures were then made from the organisms found present in the discoloured cheese. One culture was made from a poured dilution of the *Proteus* and yeast, the second from a mixed culture of yeast and mould spores. Blank control plates were also incubated at the same time.

The plate containing the mixed culture of yeast and *Proteus* was incubated at 37° C. (98½° F.). This, in the first instance, brought along the *Proteus*, and at the end of forty-eight hours' incubation the plate was removed and examined. Examination showed that no surface or isolated colonies were visible, but a dark, muddy discoloration had spread unevenly through the body of the plate. From this discoloured portion the *Proteus* organism was seen in considerable numbers when smears were examined microscopically. This plate was then incubated for another three days at 20° C. and re-examined. This time the smears from the discoloured portion showed a marked increase in yeasts, with a lightening of the discoloration, and in one place where yeast cells were markedly predominant a definite bleaching had occurred not only on the surface, but through the body of the medium. This culture showed quite definitely the possible action of certain members of the *Proteus* group in the presence of lead in dairy products

The second culture, containing the yeast and the *Penicillium* mould, was incubated for five days at 20° C. The mould, though a luxuriant growth was obtained and the medium proved ideal for its growth, showed no signs of causing any discoloration, but in isolated portions of the plate, where the mould had not established itself and the yeast had been able to develop, a surface bleaching occurred.

No claim is made in this report that the yeast isolated is the cause of bleaching. The possibilities of the *Proteus* group, however, in conjunction with the presence of lead, are obvious.

It is interesting to find that in some cheeses the bleaching and the dark discoloration appear together, and that a considerable number of yeasts are found present in the dark portions, apart from their predominance in the bleached areas. It seems possible that in some cases the bleaching commences first, to be followed by the action of the *Proteus* type, together with the presence of lead, the yeasts gradually decreasing in number as the darkening occurs.

The predominance of yeasts in discoloured cheese of this particular line has also been reported from Reading.

PRECOOLING OF APPLES FOR EXPORT SHIPMENT.

R. SUTHERLAND, Cool Storage Officer, Horticulture Division.

THE process of cooling fruit in a ship's hold is somewhat slow, and this applies particularly to the older type of vessel not designed for the carriage of fruit. In consequence the product is apt to arrive at its destination in an overripe or wasty condition, resulting in heavy economic loss to the grower and consumer, as well as varying financial loss to all parties interested in the distribution. The last few years have seen a marked development in the practice of precooling a portion of our cargoes of perishable fruits before long-distance shipment to the marketing centres. Precooling is a pronounced step towards efficiency, one of the principal arguments in its favour being that fruit can be quickly reduced in temperature to a point where ripening and disease development is retarded — temperature, humidity, and products of respiration playing an important part in the life-history of fruit.

New Zealand is essentially a primary producing country, exporting its fruit, meat, and dairy-produce to Britain and other parts of the world. But although fruit is a living organism which respires rapidly at high temperatures, it is the only one of these products which up to the present is not all cooled to its transport temperature before shipment. Refrigeration has long been used as an agent in the preservation of our foodstuffs, and plays a most important part in the development of the fruit industry. In addition to retarding the ripening process it is equally important in checking any tendency toward decay. Practically every case of decay known to the industry develops from some minute organism, either bacterial or fungal. Most of these organisms thrive at ordinary temperatures, while they become dormant at temperatures round about freezing-point.

Investigations extending over a lengthy period tend to demonstrate that the sooner fruit is cooled after picking the longer it can be preserved in cool storage. The interval between picking and the ultimate cooling of the fruit in the ship's hold under existing conditions may sometimes extend to several weeks, which greatly reduces its storage life, resulting in rapid deterioration, owing to the high temperatures to which the fruit has been exposed in its early stages. The value of precooling before shipment has not been fully realized, although it is admitted that cooling a large body of closely stowed fruit on shipboard is a big task; weeks may elapse before favourable conditions are obtained, owing to the difficulty of conveying the refrigeration uniformly throughout the cargo. The alternative is to precool the fruit before shipment, and thereby place it on the vessel in ideal condition.

Although scientists and practical investigators into this important matter agree that precooling is highly advantageous, it is not intended to suggest that by an extension of the present precooling facilities all our transport problems would disappear, as there would still be room for considerable improvement in the methods of ventilating the holds and distributing the refrigeration throughout the fruit cargo.

The rate of loading a ship's hold is somewhat faster than in a land store, where usually only a few hundred cases of fruit are stowed daily.

These stores are generally equipped with a refrigerating plant and a system of air circulation capable of reducing the temperature rapidly; also, the engineer is able to gain access to the chambers for the purpose of observing the temperatures and regulating the distribution of the refrigeration to the various sections of the chambers accordingly. On the other hand, the ship's holds are filled in a few days, thousands of cases of fruit being loaded daily, and immediately the hatches are put on the ship's refrigeration has not only to cool down the great bulk of closely stowed cases, but has also to remove the heat developed by the fruit, which after picking continues to respire, the rate of respiration being proportional to the temperature of the fruit itself. All fruits, in common with other living things, consume oxygen and produce carbon dioxide. This process of respiration does not cease at cool-storage temperatures, but is merely slowed down. The rate of respiration is dependent on several other factors, such as the kind of fruit and degree of maturity.

Any delay between gathering and cool storing greatly reduces the storage life of the fruit, resulting in early deterioration. At high temperatures ripening goes on rapidly, and delay before storage exposes the fruit for a longer time to a high temperature. Thus the end of its life comes much sooner than it otherwise would. The product will also show a larger proportion of physiological and fungal decay than it would if it were placed in cool storage immediately after picking.

If fruit is not precooled before shipment, then the heat must be extracted on board ship. This can only be achieved by temperature difference, and, as additional heat is being produced continuously by the fruit, the temperature of the latter for the greater part of the voyage must remain above that of the atmosphere of the hold in which it is stowed. If an attempt is made to force a reduction in the temperature too quickly there is a danger of the fruit nearest the cold brine grids or the incoming cold air being frozen.

In order to minimize the difficulties of reducing the temperature and producing suitable conditions for fruit transport in the shortest time on shipboard, precooling must be resorted to. This can be accomplished in cool-storage rooms on land equipped with an efficient refrigerating plant and air-circulating system for distributing the refrigeration throughout the storage chambers. As space in land storage is not so valuable as it is on board ship the cases of fruit can be stowed in such a manner (in a number of small compartments) that relatively low and uniform temperatures can be maintained, reducing the apples to 33°–35° F. within four to five days; whereas, owing to the larger quantities of fruit stowed in the ship's hold daily, a similar reduction in the temperature may take three to four weeks. Then, again, the reduction in the temperature will not be uniform throughout the cargo of apples. This factor of uneven cooling emphasizes the necessity of precooling the fruit before shipment, so that all the apples will be properly protected at the start of the voyage overseas.

The fruit must be transported to the ship as quickly as possible after removal from the precooling stores, and every precaution taken to maintain uniformly low temperatures during loading. The holds should be well cooled down before loading commences at the port of shipment, in order to extract the heat from the insulation, and every

opportunity should be availed of when working of the cargo ceases temporarily to circulate the cold air and secure a reduction in temperature, even if it be only a few degrees. In the process of precooling the fruit is reduced in temperature to a point where respiration is slow, minimizing the danger of the accumulation of carbon dioxide.

The function of refrigeration is not only to reduce the temperature of the air, but, what is of equal importance, the relative humidity of the air is reduced. It is well known that a damp or saturated atmosphere is conducive to the growth of moulds and fungi, the spores of which are often on the fruit when it leaves the orchard.

In order to compete successfully with other fruit-exporting countries it is essential that general precooling be adopted, so that our fruit may be exported under the best possible conditions.

TESTING OF PUREBRED DAIRY COWS.

INTRODUCTION OF ADDITIONAL 305-DAY TEST AND NEW BUTTERFAT STANDARDS.

W M SINGLETON, Director of the Dairy Division, Wellington.

The 305-day Test.

A MOVEMENT in the direction of inaugurating a 305-day class for Certificate-of-record cows has been in existence in New Zealand for a number of years, having originated as far back as April, 1921. The matter was gone into very fully at the time, and the then Minister of Agriculture approved of the introduction of this alternative test, provided reasonably representative support was offered by our breeders of purebred dairy cattle When the breeders were approached, however, it was discovered that very few entries for such a class were likely, and that the trend of opinion appeared to be very distinctly in favour of the full-year test as originally introduced.

The subject was revived last year, when at a meeting of the New Zealand Jersey Cattle Breeders' Association, held in June, a resolution was passed to the effect that the Department of Agriculture be requested to inaugurate an additional C.O.R. test for Jersey cows and of 305 days' duration. The various other purebred dairy-cattle associations co-operating in the C.O.R. test were approached, and it was apparent that the 305-day class was at last to find more general favour. Our New Zealand breeders were no doubt influenced by the trend in the United States, where, particularly with the Jersey breed, there is a distinct tendency for the 305-day class to take the position previously held by the full-year test. The Dairy Division is not in possession of statistics relating to all breeds in the United States, but, so far as the Jerseys are concerned, we are advised that 1,168 records were completed in the 365-day class for 1928–29 as against 1,566 records in the 305-day class. Some 22·9 per cent. of the Advanced Register Jersey entries in 1922–23 were for the 305-day test, while in 1928–29 the percentage had reached 57·38, with a consistent upward trend throughout the intervening years.

There is much to be said for and against the 305-day class as compared with the full-year period. From the wider point of view it may be said that the C O.R. test as introduced here by the Dairy Division in 1912 was brought into being for the purpose of providing registered purebred sires and dams—particularly registered purebred sires—with butterfat pedigree backing, to act as a foundation and a breeding basis for the Dominion's ordinary grade and crossbred dairy herds. To reiterate a frequent statement, the average dairy cow in New Zealand milks for a comparatively short lactation period, the average being somewhere around the eight months' mark. It is contended that this period could profitably be increased, which would in turn raise our average, and therefore our total butterfat production for the same number of cows. The accepted principles of heredity have been sufficiently tested to make it a reasonable assumption that the average lactation period for New Zealand should gradually increase by crossing registered purebred bulls, from cows which have been proved to have produced profitably for a full year, with our ordinary grade and crossbred factory-supply herds.

The position from the dairy-farmer's point of view is that the 305-day test conforms more to the average dairying practice, and that the full-year test with its fifteen months' period between calving throws the cows out of season, and therefore upsets the systematic operation of the dairy herd This may be so, and there are no doubt a number of small farmer-breeders who are affected, particularly those whose herds include one or two registered purebred individuals. It may also be contended, however, that the breeding of purebred dairy cows is more a matter for the specialist—that is to say, the man who devotes his whole energies to the breeding and development of purebred dairy cattle.

Needless to say, the 365-day class will continue as in the past, and will no doubt receive support from the majority of our specialized breeders of purebred dairy cattle, and it is hoped that the 305-day class will swell our C.O.R. entries by way of opening up an avenue of activity for those farmer-breeders previously mentioned who find C.O.R. yearly test inconvenient for their purpose.

The Dairy Division is now accepting entries for the 305-day division of the C.O.R. test. Rules governing the new class are in the course of preparation, and each testing breeder will receive a copy as soon as possible after the rules have been finalized. In the meantime it is desired to make breeders conversant with the more important proposals, so that they may be aware of the qualifications necessary for certificates. The existing general C O.R. rules for the yearly test will apply equally to the shorter testing-period. Following are points on which information may be desired :—

(1) Application.—Application for testing in the 305-day division is to be made on the same form and in the same way as for the full-year C.O.R. test, provided that the applicant must indicate whether the entry is for the yearly or the 305-day division. In the case of cows entered in the 305-day division, it will be incumbent upon the owner, should he afterwards desire the testing continued beyond the 305-days, to advise the testing officer of this fact not later than the ninth monthly test.

(2) Fees.—Fees for the 305-day test will be the same as for the yearly test—namely, 8 guineas for the first cow each season and 3 guineas

for each subsequent entry; provided that in the event of a cow qualifying for certificate under both divisions within the one testing period, the owner will be entitled, on payment of a certification fee of 10s 6d., to receive both a 305-day and a yearly certificate.

(3) Calving Requirements.—No four-year-old or mature cow is eligible for entry for the 305-day division unless she has dropped a living or mature calf within 395 days (thirteen months) prior to the calving for commencement of test; and every cow in order to qualify for a 305-day certificate must drop a mature calf within 395 days (thirteen months) after the calving for commencement of test. For second-class 305-day certificates an extra thirty days will be allowed, making a total of 425 days between calving for test and calving subsequent to test.

(4) 305-day Butterfat Standards.—The following minimum butterfat standards may be accepted in the meantime as applying for the 305-day division. These, it will be noticed, are 25 lb. less than the new standards for the full-year division as provisionally notified at the conclusion of this article.

2 years and under ..	250·5 lb.	Increasing by $\frac{1}{10}$ lb. butterfat for each day from two years to five years of age
3 years and under ..	287·0 lb.	
4 years and under ..	323·5 lb.	
5 years and over ..	360·0 lb.	

The titles decided upon for future use are "C.O.R. (Yearly) Test," and "C.O.R. (305-day) Test." Breeders and others can assist us to avoid confusion by endeavouring to make sure that these descriptions are strictly adhered to in connection with any advertising or other reference to Certificate-of-record testing.

With the introduction of the 305-day test for purebred dairy cows New Zealand dairy-herd owners may be considered to be extremely well catered for. Persons informed regarding the testing of dairy cows will know that this makes the fifth system to come into operation in New Zealand. There is the Association system for the breeder in outlying and scattered districts. This was the Division's original scheme, introduced in 1909, and it has rendered considerable service. Following on the Association system the C.O.R. test was inaugurated. This was in 1912, and catered for registered purebred dairy cows. In 1922 the Group system for the testing of ordinary herd cows came into existence, and it has grown so rapidly that to-day it is the most heavily supported system in New Zealand, and each year shows a rapid increase in favour. One stage further is the Official Herd-test, which came into operation in 1927, and gives opportunity for the testing of purebred dairy cows on a herd basis. This system has not been availed of to the extent that was anticipated, although the support has been promising. To complete the chain there is now the 305-day test, which in some respects may be regarded as a sort of half-way mark between the Official Herd-test and the Certificate-of-record yearly test.

The influence of the new class on the future of the purebred dairy cow is difficult to forecast. If it is instrumental in fostering a wider support of the C.O.R. testing system, then the new class will have rendered no small service, and this fact alone may be considered sufficient to warrant its introduction. The only doubtful point, however, may be its influence in the direction of shortening the existing average lactation period of our tested purebred dairy cows.

Butterfat Standards for the Full-year Test.

The question of the introduction of the 305-day class has given rise to discussion concerning the existing C.O.R. standards for the 365-day period. Some breeders have been in favour of the elimination of the standard, although the majority appear to prefer to see the existing standard raised Here, again, there is something to be said on both sides. The raising of the standard would have the tendency to show the production of our average certificated purebred cow in a better light, and would also demand more careful selection and better handling of entries. On the other hand, a standard naturally implies a barrier or border line, and there will always be odd cows whose production places them just on the wrong side of the barrier. Our records show a number of instances of cows which have qualified by a bare pound of butterfat and other cows which have failed to qualify by a narrow margin. This naturally means that the one cow enjoys the credit and advertisement connected with a Certificate-of-record, while the other does not; moreover, her record of production may also be omitted from pedigrees and general advertising. In actual practice one cow may be as good as the other. As a general rule standards are automatically set by the average production of the various classes.

There is also the fact that if every tested cow were certificated irrespective of her yield and provided she qualified in other respects—that is to say, on calving, &c.—then full particulars of every tested cow would be available to students or prospective buyers, and consequently many pedigrees could be more complete from the viewpoint of butterfat-production figures.

Breeders are hereby advised that it is proposed to increase the minimum butterfat requirements for the 365-day C.O.R. test. Although the amounts have not yet been finally fixed, it may be provisionally accepted that the following standards will apply in future :—

2 years and under	..	275·5 lb.	Increasing by $\frac{1}{10}$ lb butterfat for each day from two years to five years of age.
3 years and under	..	312·0 lb	
4 years and under	..	348·5 lb.	
5 years and over	..	385·0 lb.	

In the event of any change being made in the above-quoted standards the subject will be recurred to in the *Journal*.

"*Donin*" *Butter-starter Culture* —This culture is a preparation made in Switzerland for producing the most desirable flavour in butter, and some time ago samples of the preparation were received from Mr. W Wright, London. Experiments were carried out at several factories in the Auckland and Wellington Provinces by using similar cream treated and not treated with the culture In no case did the butter from the treated cream score higher at the time of grading, nor was the flavour so good as that of the non-treated, after the usual two months' cold storage.—*Dairy Division.*

"*Wheat-manuring Experiments in the South Island.*"—Table 35 of this article, printed at the bottom of page 50 in last month's *Journal*, was inadvertently misplaced. It should be read as at the top of that page, immediately before its related comments beginning "Comparisons between super 2 cwt. and super 1 cwt."

IDENTIFICATION OF COWS FOR CERTIFICATE-OF-RECORD AND OFFICIAL HERD-TEST.

THE EAR TATTOO SYSTEM ADOPTED.

Dairy Division.

EVER since the commencement of the Certificate-of-record Test for purebred dairy cows the need for a system of identification, particularly with the Jersey breed, has had consideration by the Dairy Division. The matter is one of the oldest of herd-testing problems, and it is doubtful if it has yet been satisfactorily solved. By identification is meant the marking of cows in such a way as to make them individually, permanently, and conveniently distinguishable, even to persons who have never before seen them. Moreover, to be entirely perfect an identification system should not permit of undetectable manipulation. Therein lies the principal difficulty.

It is not intended to suggest that substitution takes place; in fact, in the whole of the Division's testing experience we have had no case where there was the slightest cause for suspicion of such a procedure. There are, however, some fairly large herds under official test, and as a rule testing officers do not see the cows more than once a month, so that it is difficult to remember the various individuals, particularly with the Jersey breed, where there are no broken colour markings to note, and few distinguishing features. Testing officers take descriptive notes of cows under test, but these are not always sufficient in the case of change of testing officer. This, however, is the narrower aspect of the case. The broader view is to be found in considering the advantages of satisfactory identification during the time animals are on test, and a convenient and safe means of permanently linking up the animal with its butterfat record

The Dairy Division has tried several identification methods, but with little success. The first experiment was with a chain round the base of the horns, and a strong padlock to which there was no duplicate key, the lock being numbered and also carrying the Government's mark of the broad-arrow. This method had proved very successful among the owners of purebred dairy stock in the Island of Jersey. In New Zealand, however, where many of the herds are allowed to run free on more or less broken country, the cows were apt to get the chains torn off on fences and logs, and consequently this method was abandoned. In any case the chain method still left unsolved the problem of the ever-increasing polled or dehorned cow.

Next was tried a leather collar with a padlock, but, apart from being unsightly, this method met with the same fate as that of the chain round the base of the horns.

A third experiment was made with aluminium ear-tags While these are now in fairly wide use, and appear to be giving satisfaction to many users, we found that several of the C.O.R. cows on which they were tried ripped them out, and in doing so considerably disfigured the ear. Consequently the ear-tag method was discontinued.

Four things go to the making of a perfect identification system. It must be convenient to apply and easy to decipher; it must permit of a distinct mark for each animal and withstand interference. There is also a fifth which is of increasing importance—the cow must not be disfigured from the viewpoint of entry in the show ring. For one or other of these reasons firebranding on the horns, hoofs, or skin, or the use of clumsy appendages is not desirable.

The Ear Tattoo System.

A system which is growing in favour, and has now been in operation sufficiently long to prove itself, is the tattoo-mark in the ear. This appears to possess most of the desirable attributes, while from the aspect of safety, the more calves marked at birth the fewer unmarked cows will the future hold, and consequently the possibility of irregular practice will grow less as time goes on.

For the information of any breeder or owner of purebred dairy cattle of any of the breeds participating in the C.O.R. test (except Friesians, which are referred to later), and who may contemplate making entries for Certificate-of-record or Official Herd-test, we desire to make it known that no cow or heifer born on or after the 1st July, 1930 (that is to say, having her first calf as a two-year-old in 1932) will be eligible for acceptance for either of the tests mentioned unless such animal is suitably identifiable by tattoo-mark in the ear. This means that the cow or heifer must be individually identifiable by a distinct tattooed mark or number or code, and that an owner's herd brand or herd mark alone will not be considered sufficient identification for the purpose of entry for Certificate-of-record or Official Herd-test.

Breeders are advised to communicate with the secretary of their breeders' association regarding the tattooing of their calves. The secretary will doubtless have full details as to tattoo outfits and the application of the tattoo, and the association will probably wish to have some uniformity as to the system adopted by its members. Moreover, the system of marking for identification purposes should be in conformity with the system of marking registered by the respective breeders' associations. We also wish to make it clear that the course outlined is necessary only where there is not already sufficient identification by tattoo. Neither is any further action necessary in the case of animals already marked in connection with the Dominion Group Herd Testing Federation's calf-marking scheme.

Photographs for Friesians.—On account of the distinctive markings of Friesian cattle it is intended to rely upon photographs for this breed. A rule providing for photographs for identification is already embodied in the C.O.R. rules, and it is intended to enforce this rule in future.

Conclusion.

It is considered that the introduction of an identification system for Certificate-of-record and Official Herd-test cows represents the fulfilment of a long-standing need and is an improvement in the service. It is recognized that breeders who are not already tattooing will be involved in a little expense and trouble, but the result should be to the ultimate advantage of all dairymen, and particularly to the breeders and owners of our purebred dairy cattle.

THE OFFICIAL SEED-TESTING STATION.

RECORD OF OPERATIONS FOR YEAR 1929.

N. R. Foy, Seed Analyst, Plant Research Station, Palmerston North

During the calendar year 1929 a total of 9,153 samples were received for testing at the Department of Agriculture's Seed-testing Station, this being a decrease of 996 on the number received the previous year. However, with the increase in the number of requests for purity analyses, the number of tests made during the year amounted to 12,244, or only 3 per cent. less than in 1928.

Tables Nos. 1, 2, 3, 4, and 5 give information concerning the distribution of the samples received, origin, classification, &c. The 879 samples shown for the Plant Research Station in Table 1 consisted as follows :—

Seed-testing Station, 387—Experimental, storage, and special tests

Mycology Section, 289—Tests on control and treated samples in connection with experimental control of seed-borne diseases.

Agrostology Section, 179—Tests on samples used in pasture-plant investigation.

Crop Experimentalist 25—Seed used in plot experiments.

Table 1.—Origin of Samples received, 1929 and 1928

Senders, &c.	Number of Samples. 1929.	Number of Samples. 1928.
Seed-merchants	7,827	8,509
Farmers and seed-growers	138	206
Government Departments other than Agriculture	67	365
Department of Agriculture—		
Fields Division	99	54
Plant Research Station	879	890
Retests	143	115
Totals	9,153	10,149

Table 2.—Number of Samples received each Month, 1929 and 1928.

Month	Number. 1929.	Number. 1928.	Month.	Number. 1929.	Number. 1928
January	483	666	July	1,007	881
February	754	871	August	833	925
March	835	1,086	September	891	727
April	1,118	872	October	728	995
May	1,008	950	November	579	870
June	638	984	December	279	322

Table 3.—Classification and Numbers of Samples and Tests, 1929 and 1928.

Classification	Number.	
	1929.	1928.
Samples for germination only	5,953	7,555
Samples for germination and purity	3,101	2,505
Samples for purity only	89	89
Purity tests made	3,190	2,594
Germination tests made	9,054	10,060
Totals	12,244	12,654

Table 4.—Number of Samples from the different Land Districts and Centres therein, 1929 and 1928.

Land District, &c	1929.	1928.	Land District, &c.	1929.	1928.
Southland (total)	**2,258**	**2,950**	Canterbury (total)	**947**	**1,189**
Gore	1,235	1,417	Christchurch	555	667
Invercargill	977	1,465	Other	392	522
Other	46	168	Otago (total)	**814**	**732**
Wellington (total)	**1,950**	**2,221**	Dunedin	725	698
City	1,061	1,055	Other	89	34
Palmerston North and Feilding	629	799	Taranaki	**438**	**328**
			Hawke's Bay	**307**	**238**
Other	260	387	Marlborough	**104**	**174**
Auckland (total)	**1,093**	**1,191**	Gisborne	**17**	**23**
City	1,013	974	North Auckland	**1**	..
Other	80	217	Nelson	..	**13**
			Westland	..	.
			Overseas	**40**	.

Table 5.—Number of Samples of various Species reported on during 1929 and 1928, and Number of Tests made thereon, 1929 (excluding Laboratory Tests).

Species.	1929.			1928.
	Germination Tests.	Purity Tests.	Samples.	Samples.
Perennial rye-grass (*Lolium perenne*)	1,594	219	1,600	2,292
Italian rye-grass (*Lolium multiflorum*)	287	51	287	406
Western Wolths rye-grass (*Lolium westwoldicum*)	146	21	146	186
Cocksfoot (*Dactylis glomerata*)	430	147	438	433
Crested dogstail (*Cynosurus cristatus*)	747	538	770	954
Chewings fescue (*Festuca rubra* var. *fallax*)	697	571	722	678
Brown-top (*Agrostis tenuis*)	627	627	627	357
Danthonia pilosa	61	6	62	69
Danthonia semi-annularis	..	2	2	3
Timothy (*Phleum pratense*)	89	34	89	123
Fog (*Holcus lanatus*)	38	37	42	31
Meadow-fescue (*Festuca pratensis*)	31	11	31	26
Meadow-foxtail (*Alopecurus pratensis*)	51	27	52	37

Table 5—continued.

Species.	1929 Germination Tests.	1929 Purity Tests.	1929 Samples.	1928. Samples.
Paspalum (*Paspalum dilatatum*)	124	8	124	71
Poa pratensis	38	18	38	52
Poa trivialis	12	5	12	12
Prairie-grass (*Bromus unioloides*)	22	2	22	20
Fiorin (*Agrostis stolonifera*)	4	1	4	7
Red-top (*Agrostis palustris*)	8	6	8	7
Yarrow (*Achillea millefolium*)	33	22	33	48
Other grasses, &c.	15	1	15	15
Total grasses	5,054	2,352	5,124	5,827
White clover (*Trifolium repens*)	326	203	334	413
Red clover (*T. pratense*)	293	110	296	300
Alsike (*T. hybridum*)	63	30	63	73
Alsike and white clover	26	19	26	16
Subterranean clover (*T. subterraneum*)	35	4	35	35
Strawberry clover (*T. fragiferum*)	10	2	10	4
Crimson clover (*T. incarnatum*)	33	4	33	44
Suckling clover (*T. dubium*)	35	25	37	34
Lucerne (*Medicago sativa*)	87	20	89	105
Trefoil (*M. lupulina*)	27	7	27	30
Lotus major	76	52	77	82
Lotus hispidus	24	17	24	20
Other clovers, &c.	18	4	18	8
Total clovers, &c.	1,053	497	1,069	1,164
Swede (*Brassica campestris*)	253	10	253	334
Turnip (*B. rapa*)	355	12	355	412
Rape (*B. napus*)	100	8	110	91
Kale (*B. acephala*)	82	3	82	104
Mustard (*B. arvensis*)	20	1	20	24
Mangel (*Beta vulgaris*)	248	14	248	235
Carrot (*Daucus carota*)	118	2	118	101
Totals	1,185	50	1,186	1,301
Oats (*Avena sativa*)	24	..	24	28
Wheat (*Triticum vulgare*)	54	..	54	16
Barley (*Hordeum vulgare*)	27	..	27	15
Rye-corn (*Secale cereale*)	13	..	13	6
Tares and vetches (*Vicia* spp.)	3	..	3	4
Peas (*Pisum sativum*)	161	..	161	197
Japanese millet (*Echinochloa frumentacea*)	27	..	27	23
Other forages	63	40	64	10
Vegetables (other than peas)	398	..	398	386
Flower seeds	90	..	90	77
Forest-tree seeds	31	..	31	117
Seed mixtures	133	9	26	50
Totals	1,024	49	918	929

Table 6.—Showing Number of Samples tested for Purposes of the Canadian Seeds Act, and Grades into which the Seed would probably be placed when graded in Canada (1929).

Species.	Number of Samples	Grade No. 1.	Grade No. 2.
Chewings fescue	12	12	..
Dogstail	1	1	..
Brown-top	2	2	..
Cow-grass	9	3	6
White clover	1	..	1
Totals	25	18	7

Grass-seeds.

The average percentages of germination and seed impurities of the grass species are given in Table 7, and those of the main species produced in New Zealand in Table 8.

Rye-grasses.—A distinct improvement in the germination of perennial rye-grass is shown, with nearly one-third of the samples germinating 90 per cent., and over two-thirds 80 per cent. or better, compared with one-tenth and less than half respectively for the previous year. Although an improvement is shown for Hawke's Bay samples, the seed from this district has not regained the high average figure always associated with Hawke's Bay rye-grass three or four years ago. The same remarks apply almost equally to samples from Poverty Bay, of

Table 7.—Average Germination and Percentage of Extraneous Seeds in the Main Grass Species, 1929.

Species.	Germination Percentage: Average 1929	Average 1928.	Maximum.	Minimum.	Percentage of Samples germinating in the Groups—: 50–59.	60–69.	70–79.	80–89.	90–100.	Average Percentage of Impurities: Commercial Seeds.	Weed-seeds.
Perennial rye-grass	81	75	99	2	7	8	17	37	31	1·1	0·5
Italian rye-grass	79	78	98	8	6	10	29	34	21	0·1	0·4
Western Wolths	77	79	99	4	8	14	27	28	23	0·1	0·4
Cocksfoot	67	68	94	7	15	24	33	23	5	5·0	0·4
Crested dogstail	94	90	100	39	1	1	3	8	88	0·8	0·2
Chewings fescue	91	82	100	6	1	1	6	12	80	0·8	0·3
Brown-top	93	87	100	10	1	1	4	8	86	0·2	0·4
Timothy	85	81	100	5	8	9	5	9	69	0·3	0·1
Meadow-fescue	70	78	100	2	26	13	16	3	42	0·3	0·3
Poa pratensis	50	64	92	5	70	16	8	3	3	0·2	0·7
					0–29	30–39	40–49	50–59	60–100		
Danthonia spp.	29	49	85	9	34	23	16	10	17	0·8	0·3
Meadow-foxtail	21	31	60	1	74	12	6	2	6	1·3	1·8
Paspalum	33	47	80	2	45	17	6	19	13	0·3	0·7

which less than half germinated over 70 per cent The average of 3·6 per cent. of seed impurity shown for Hawke's Bay rye-grass is made up of almost equal proportions of useful crop seeds and weed-seeds, the former consisting mainly of cocksfoot and the latter of goose-grass and hair-grass. This average can hardly be taken as a standard for Hawke's Bay seed, however, as a number of samples are included which were unusually high in impurity.

Awned Italian rye-grass occurred in the perennial rye-grass samples examined as follows: All samples, 72 per cent.; Southern 75 per cent.; Canterbury, 88 per cent.; Hawke's Bay, 51 per cent. In samples definitely labelled "perennial rye-grass" the maximum occurrence of awned seed of Italian was 13 per cent. Forty-five per cent. of the samples of perennial examined contained ergot, with a maximum content of 1·9 per cent. and an average of 0·1 per cent Of the Italian rye-grass and Western Wolths samples, ergot occurred in 1 per cent. and 2 per cent. respectively.

Cocksfoot.—Little variation from the normal germination percentages is shown in cocksfoot for 1929. The percentage extraneous seeds over all samples is approximately 1 per cent. higher than in 1928, due to

Table 8.—Average Germination and Percentage Seed Impurities of the Main Grass-seeds grouped according to Origin, 1928 and 1929.

Place of Origin.	Average Percentage of Seed Impurities	Percentage of Samples germinating in Groups— Below 70.		70–79.		80–89.		90–100.		Average Germination.		Number of Samples.	
		1928.	1929.	1928.	1929.	1928.	1929.	1928.	1929	1928	1929	1928	1929
Perennial Rye-grass.													
Dominion*	1·6	28	15	28	17	33	37	11	31	76	81	2,285	1,592
Southern ..	1·1	23	6	29	14	38	41	10	39	76	85	1,497	797
Canterbury	1·7	30	20	28	23	29	33	13	24	74	80	336	258
Sandon ..	0·7	20	18	26	16	23	28	21	38	76	82	117	127
Hawke's Bay	3·6	49	24	23	25	15	34	13	17	68	76	101	223
Poverty Bay	1·3	46	55	25	12	20	21	9	12	62	67	45	51
Cocksfoot													
Dominion*	5·4	51	39	30	33	14	23	5	5	68	67	430	430
Danish ..	0·5	25	20	44	50	31	24	0	6	74	74	96	78
Akaroa ..	3·7	74	54	19	32	7	12	0	2	64	69	116	115
Plains ..	14·6	31	34	31	28	27	28	11	10	75	74	45	55
Crested Dogstail.													
Dominion*	1·0	3	1	2	3	10	8	85	88	90	94	941	747
Southern ..	1·0	1	1	2	3	9	7	88	89	94	94	789	656
Sandon ..	1·1	2	1	8	7	19	8	71	84	90	92	85	69
Chewings Fescue.													
Southern ..	1·1	10	2	7	6	16	12	67	80	82	91	661	697
Brown-top.													
Dominion*	0·6	7	1	4	5	6	8	15	56	68	93	355	627
Southern ..	0·5	4	1	5	3	14	8	77	88	91	94	204	494
Waipu ..	2·2	18	21	7	7	26	16	49	56	83	84	43	18
Canterbury	0·8	14	5	6	6	10	12	70	77	86	92	70	103

* Includes all samples.

the high rye-grass content of Plains seed, which gave an average percentage of 14·6, practically the whole of this being made up of rye-grass. Rye-grass occurred in all the samples of Akaroa seed examined, but the extremely high rye-grass content of some of the samples (up to 20 per cent.) would lead one to the opinion that the seed was grown on the Plains and was being sold as Akaroa.

Crested Dogstail.—Nearly 90 per cent. of the samples of dogstail received germinated 90 per cent. or over. Californian thistle occurred in 45 per cent. of the samples examined—from one to two hundred seeds per ounce, with an average of twelve per ounce.

Brown-top.—Table 9 gives average test figures on the samples of brown-top, all of which were tested under the International testing system. Southern seed, with an average pure germinating percentage of 90·1 per cent., shows particularly good quality.

Other Grasses.—The average germination percentages of grass-seeds not mentioned in Table 7 were as follows:—

Yorkshire fog	94	Indian doob	82
Poa trivialis	45	Ragstail	80
Prairie-grass	89	Tall fescue	82
Fiorin	92	Sheep's fescue	49
Red-top	94	Spartina Townsendii	20
Yarrow	64	Phalaris tuberosa (bulbosa)	72

Table 9.—Average Percentages of Pure Seed, Germination, and Pure Germinating Seed in Samples tested under the International Testing System, 1929.

Seed.	Purity				Germination (of Pure Seed)	Pure Germinating Seed.
	Pure Seed	Inert Matter.	Other Crop Seed.	Weed-seed.		
Brown-top—						
Dominion	96·3	2·8	0·2	0·4	93·1	89·2
Southern	96·9	2·3	0·1	0·4	93·6	90·1
Canterbury	95·8	3·5	0·2	0·6	91·8	87·4
Waipu	84·1	13·6	1·4	0·8	83·8	70·3
White clover—						
Certified seed	95·7	1·4	2·7	0·2	82·1	78·3

CLOVERS AND RELATED SPECIES.

The average percentage of germination and percentage of impurities for the main clovers, &c., is shown in Table 10. The general averages vary but little from those of previous years.

Suckling clover occurred in 88 per cent. of the white-clover samples examined, at the rate of 0·1 up to 60 per cent. Rib-grass, sorrel, catchfly, and fathen were the most constantly occurring impurities in white clover. Dodder was noted in 3 per cent. of the samples and in small quantities only.

The average germination percentages of other clovers, &c., not included in Table 10, were as follows:—

		Hard Seeds.
Alsike and white (mixed)	78	10
Cluster clover	55	42
Bokhara clover	90	4
White and suckling (mixed)	78	18
Lotus corniculatus	49	26
Melilotus arvensis	21	41

Table 10.—Average Germination and Percentage Seed Impurities of the Main Clovers and Related Species, 1929.

Species	Percentage of Germination. Average. 1928	Percentage of Germination. Average. 1929	Maximum.	Minimum.	Percentage of Samples germinating in Groups 0–69.	70–79.	80–89.	90–100.	Seed Impurities. Number of Species. Crop Seeds.	Weed-seeds.	Average Percentage. Crop Seeds.	Weed seeds.	Average Percentage of Hard Seeds.
White clover ..	84	85	90	2	7	16	32	45	24	54	4·4	1·0	10·5
Red clover ..	86	85	100	8	12	5	7	76	24	56	0·5	0·5	4·6
Alsike ..	88	82	96	7	8	20	27	45	9	29	1·0	0·1	5·0
Subterranean clover	86	73	98	0	14	9	35	28	4	6	0·1	0·1	18·4
Strawberry clover	72	74	92	43	40	10	30	20	5	9	3·2	4·3	23·4
Crimson clover ..	55	66	90	3	39	3	3	55	4	10	0·4	0·2	0·0
Suckling clover	66	65	91	19	60	20	17	3	13	31	15·2	4·9	26·4
Lucerne ..	80	78	95	24	28	16	31	25	9	18	1·5	0·3	12·1
Trefoil ..	68	86	98	33	15	..	9	76	5	10	0·2	0·1	6·8
Lotus major ..	76	66	90	26	42	37	18	3	12	38	12·9	0·5	17·1
Lotus hispidus ..	53	55	76	30	88	12	..	..	16	21	20·8	0·7	30·5

Table 11.—Average Germination and Percentage of Seed Impurities of White and Red Clovers according to Origin, 1929.

—	Germination. Average.	Hard Seed.	Percentage of Samples germinating in Groups— 0–69.	70–79.	80–89.	90–100.	Seed Impurities. Crop Seeds.	Weed-seeds.
*White Clover.**								
New Zealand	86	11·1	5	17	38	40	4·5	1·0
New Zealand "Wild White"† ..	84	9·8	13	6	26	55	6·6	0·9
New Zealand certified seed ..	82	15·8	20	19	21	40	2·7	0·2
Imported	86	7·0	5	21	25	49	1·4	0·4
*Red Clover.**								
New Zealand	89	4·5	5	4	7	84	0·9	0·4
Imported	63	5·0	51	12	14	23	0·6	0·7

* See Table 10 for all samples. † As named by the senders of the samples.

Roots and Cruciferous Forages.

The average germination percentages for this group are shown in Table 13.

Inquiries have frequently been made concerning the germination percentages of the different varieties of root seeds—swedes, turnips, and mangels—it apparently being held by some that a low or a high germination capacity is a varietal characteristic, particularly in the case of certain varieties of mangels. Table 13 gives the percentages for the main varieties, and from these figures it will be noted that there are no great differences.

Table 12.—Average Germination Percentages of Roots and Cruciferous Forages, 1928 and 1929.

	Germination.				Percentage of Samples germinating in the Groups—									
	Average.		Max.	Min.	Below 59.		60–69.		70–79.		80–89.		90–100	
	1928	1929.	1929	1929.	1928.	1929.	1928.	1929	1928.	1929.	1928	1929	1928.	1929.
Swede ..	84	80	100	1	6	5	4	10	12	18	25	30	53	37
Turnip ..	88	86	100	1	4	4	2	6	6	8	19	24	68	58
Rape ..	92	89	99	2	1	..	2	3	3	7	18	27	76	63
Kale* ..	81	81	100	17	10	6	12	10	12	21	30	26	36	37
Mangel ..	76	68	98	8	9	26	16	27	32	33	34	12	9	2
Carrot ..	61	63	95	12	44	40	23	18	13	19	11	20	9	3

* Includes chou moellier.

Table 13.—Showing Average Germination of Main Varieties of Mangel, Swede, Turnip, and Kale, Years 1926 to 1929.

Variety.	1926.	1927.	1928.	1929	1926 to 1929. Number of Samples.	1926 to 1929. Average Germination.
			Mangels.			
Prizewinner Yellow Globe ..	72	74	74	64	168	71
Long Red	80	77	76	[illegible]	134	75
Jersey Queen	82	71	77	70	95	74
Yellow Globe* .. .	76	70	73	61	77	68
Giant Half Sugar .. .	85	82	80	73	57	79
Golden Tankard .. .	69	58	69	69	55	69
Red Intermediate .. .	85	82	78	63	48	75
Orange Globe .. .	80	76	70	66	32	72
New Smithfield Yellow Globe .	85	85	82	66	25	81
Champion Yellow Globe ..	81	83	74	..	19	79
Giant Yellow Globe .. .	..	70	81	71	16	74
New Lion Intermediate ..	91	73	81	64	11	78
			Swedes.			
Superlative	84	78	82	81	218	82
Crimson King .. .	82	75	83	79	127	80
Elephant	85	83	86	88	117	85
Champion	79	72	83	79	111	77
Magnum Bonum	81	80	80	79	79	80
Monarch	77	80	88	82	62	81
Masterpiece	77	89	88	84	41	84
Purple-top	87	87	83	92	37	87
Grandmaster	89	83	93	91	34	89
John Bull	81	81	89	86	32	85
Mervue	90	80	84	..	15	84
Empire	71	83	78	90	13	80
Vilmorin's	95	..	94	94	12	95
Bangholm	91	..	90	84	11	88
Buffalo	96	85	95	92	10	92

* Possibly Prizewinner or Champion Yellow Globe.

Table 13—continued.

Variety	1926	1927	1928	1929	1926 to 1929 Number of Samples	1926 to 1929 Average Germination.
Turnips.						
Imperial Green Globe	90	84	87	89	200	87
Purple-top Mammoth	85	90	88	85	193	86
Purple-top Yellow Aberdeen	83	81	88	84	163	84
Hardy Green Globe	90	85	90	92	152	89
Green-top Aberdeen	84	85	86	91	144	86
Devonshire Greystone	86	81	85	91	113	86
Lincoln Red Globe	89	82	90	90	106	87
Red Paragon	84	74	89	90	62	83
Romney Marsh	90	78	94	83	46	84
Fosterton Hybrid	86	81	..	..	42	84
Dale's Hybrid	..	..	92	82	27	87
Flockmaster	82	79	95	96	25	87
Waite's Eclipse	93	95	94	91	21	93
Purple-top Scotch	88	77	87	83	18	83
Renown	84	72	94	96	18	83
Invincible	85	82	93	84	17	86
Centenary	85	87	93	81	15	86
Yellow Globe	..	93	89	..	15	90
Green-top Scotch	86	70	91	86	15	83
Hardy Green Round	90	94	94	..	10	94
Early Six Weeks	89	78	92	92	9	89
Kales.						
Chou moellier*	81	78	77	78	216	78
Thousand-headed	75	85	79	79	100	80
Buda	74	75	85	92	36	82

* Includes all samples labelled "Marrow stemmed."

OTHER SEEDS.

The average germinations for the different groups—cereals, pulses, &c.—are as follows:—

Oats	77	Maize	92	Sorghum	92
Wheat	92	Tares	90	Sugar-grass	80
Barley	84	Peas	93	Linseed	94
Rye-corn	79	Millet	85	Lupins	70

EXPORT AND IMPORT OF SEEDS.

Table 14 shows the quantities and value of the seed impurities and exports for the years 1926–29.

Exports: The only marked decrease was shown in red clover (cow-grass). Both brown-top and cocksfoot show material increases. The export of brown-top is of special interest; in 1926, 475 cwt. was exported and in 1929 3,473 cwt., the value in the latter year exceeding that of the rye-grass export.

Imports: Increases are shown for red clover, lucerne, rye-grass, and Poa pratensis. The importation of rye-grass is the heaviest for many years, and is no doubt due to rising prices for locally grown seed.

Table 14.—Exports and Imports of Grass and Clover Seeds, 1926 to 1929.

Species.	1926.	1927.	1928.	1929. Quantity	1929. Value.
		Exports			
	Cwt	Cwt.	Cwt.	Cwt	£
Red clover	4,657	9,628	1,495	994	4,420
White clover	2,115	2,388	835	1,302	10,639
Other clovers	717	928	350	687	3,929
Total clovers	7,489	12,944	2,680	2,983	18,988
Brown-top	475	301	1,131	3,473	30,273
Chewings fescue	13,923	17,418	17,124	16,888	75,614
Crested dogstail	2,309	5,434	4,844	4,500	16,231
Rye-grass	29,546	50,162	20,581	25,915	26,448
Cocksfoot	*	*	496	1,183	7,158
Other grasses	4,685	4,489	3,382	3,116	7,825
Total grasses	50,938	77,804	47,558	55,075	163,549
Total grasses and clovers	58,427	90,748	50,238	58,058	163,549
Total value	£203,798	£257,136	£161,456	..	£182,537
		Imports.			
Red clover	†	†	762	1,288	5,872
White clover	†	†	1,748	1,258	7,251
Alsike	†	†	2,806	1,417	7,630
Other clovers	†	†	1,497	751	6,797
Total clovers	8,283	2,657	6,813	4,714	27,550
Cocksfoot	15,616	5,619	9,145	4,199	13,764
Lucerne	755	527	17	50	312
Paspalum	1,717	1,940	3,026	2,615	21,564
Rye-grass	334	69	20	855	1,625
Timothy	1,989	2,905	4,765	2,843	4,962
Poa pratensis	*	*	51	248	1,298
Other grasses	3,604	1,741	1,839	1,332	7,343
Total grasses	23,835	12,801	18,863	12,142	50,868
Total grasses and clovers	32,118	15,458	25,676	16,856	..
Total value	..	..	£101,373	..	£78,418

* Included in "Other grasses." † Not available.

The assistance of Mr. J. Watt, of the Station staff, in preparing the tabular matter of this report is cordially acknowledged.

Fireblight Control.—By amending regulations under the Fireblight Act of 1922, gazetted on the 3rd July, the Gisborne Commercial Fruitgrowing District is added to the Second Schedule, under which hawthorn must be dealt with at the time and in the manner therein prescribed.

CONTROL OF FERN AND BLACKBERRY ON HILL COUNTRY IN MARLBOROUGH SOUNDS.

FARMERS' EXPERIENCE AT MANAROA.

A. G. ELLIOTT, Instructor in Agriculture, Fields Division, Blenheim.

THE following article gives an account of the system developed by Messrs. Harvey Bros., at Manaroa, Pelorus Sound, for the control of fern and blackberry on hill country. The system may be held to apply to the Marlborough Sounds generally.

The land held by the Harvey Bros. is roughly 3,500 acres in area and of this 1,500 acres are still in standing bush consisting of rimu, matai, tawa, hinau, and pukatea, with typical undergrowth, and carrying red-beech ("brown birch") on the harder ridges. Of the 2,000 acres which were burned and surface-sown about twenty years ago roughly 100 acres are ploughable, and comprise a fan-shaped area fronting Pelorus Sound and into which the two main valleys open. The hill country rises to an elevation of about 2,000 ft., and is made up of approximately equal areas of sunny and shady faces.

It is on blocks of this country that the invasion of bracken hard-fern (*Paesia scaberula*) and water-fern (*Histiopteris incisa*) with blackberry forced the farmers into the present method of control of this secondary growth. On two blocks, one of approximately 100 acres and another of 150 acres, both of sunny aspect, the bracken was a solid mass 4 ft. in height with large scattered clumps of blackberry through it, and with hard-fern and water-fern well established in shaded places around stumps and beside logs.

The average annual rainfall rate of the locality is approximately 63 in.

At last shearing 2,700 sheep were shorn on the property, and the average weight of fleece from these Romney crossbreds was 8 lb., while the average lambing percentage for the year was 90. All sheep were in good condition, and the prices for lambs were equal to the best in this part of the Sounds. A few head of cattle were run, but these are not important factors in secondary-growth control in this district, as will be shown.

DEVELOPMENT OF THE SYSTEM.

In 1910 an area of approximately 1,800 acres, of which 500 acres were in surface-sown grass, was taken up and was then carrying 700 sheep. Bracken became established in the small valleys and gradually invaded the open areas, and to cope with this the old method of burning the fern and grazing it with sheep and cattle was tried, but without success. In order to carry the sheep the flats were ploughed and sown in permanent pasture, and more bush was felled. It was soon realized that control of secondary growth on the flats presented no great difficulty, but that some better method for dealing with the hill country had to be evolved, as by this time the fern and blackberry had secured a good hold on those areas.

In 1914 a further block of 900 acres, of which 700 were felled and surface-sown and carrying 600 sheep, was taken up with a result that that year the farmers had 1,300 sheep averaging a 6-lb. fleece with a lambing percentage of 87. During the next ten years burning-off of fern and blackberry, accompanied by a small amount of surface-sowing, was continued with but little success. Whole blocks which formerly carried one sheep per acre were at the end of ten years producing nothing but secondary growth.

In 1924 a reverted block of 35 acres of shady face was tackled; the heaviest blackberry clumps were chopped down, and the whole burned off during the first week in March. The area was then surface-sown with a mixture of perennial rye-grass, crested dogstail, brown-top, and white clover. During the winter it was lightly stocked with one sheep per acre, but during the summer carried three sheep per acre, and now does this regularly from October until the end of February. At present the constituents of the pasture are brown-top, crested dogstail, white clover, suckling-clover, and Yorkshire fog, with winged thistle and hydrocotyle in patches. The only traces of fern are in places inaccessible to sheep under the edges of logs, and there has been quite an effective clearance of blackberry.

In the following year a 37-acre block of part shady and part sunny face was similarly treated, and sown down with the same mixture at the rate of 10 lb. per acre. The result secured here proved quite satisfactory and convinced the Harvey Bros. that their method of sowing such mixtures and stocking with sheep was likely to be profitable.

The following year a third block of 60 acres of shady face was treated, but in this case cocksfoot was included in the surface-sown mixture with good results. The same year also a small block on the sunny face was brought back by the same method.

In 1928 a large block of 250 acres on the shady side was burned off, and took a month to surface-sow with the following grass mixture: Danthonia, 600 lb.; perennial rye, 1,320 lb.; Chewings fescue, 120 lb.; crested dogstail, 376 lb.; brown-top, 100 lb.; cocksfoot, 480 lb.; white clover, 300 lb.: total, 3,296 lb.

This works out at approximately 13 lb. of seed per acre, and since the cost of the seed totalled £113 it comes out at just over 8s. per acre.

It is estimated that two men can pack out seed and sow 10 acres of this country per day, and it is important that the sowing should be done as quickly as possible. The area was lightly stocked with one sheep per acre from the middle of June until October, when it easily carried two sheep per acre. The inclusion of danthonia and Chewings fescue has been very beneficial, and these will be included in the showing of future burns. Danthonia, although comparatively slow to establish, is of value particularly on the higher parts of the block, while Chewings fescue is probably one of the few grasses which will take on the hard beech slopes. It is doubtful whether this method of sowing so large an area will be so successful as was the case with the smaller earlier sown areas, as it is obvious that the sheep will congregate on the lower slopes, with the result that the growth of young fern and pasture grasses will not be controlled on the higher faces.

On all these areas the actual control of the young fern on the burn is done by hoggets, which are bought in when required and sold forward.

For the last three years they have been disposed of at a profit of 2s. per head, but it is obvious that their real value lies in secondary-growth control. The cattle merely have access to the blocks during the winter, but are not shut in on any of the areas as a definite factor in dealing with fern and blackberry.

MAIN POINTS SUMMARIZED.

The main points in the system practised by the Harvey Bros. are as follows :—

(1) Allow secondary growth to get away for at least three or four years, so that a good burn may be secured By this time the soil is opened up by the fern-roots, and with the ash secured from the burn a good seed-bed results. At Manaroa burning is done during the first two weeks in March

(2) Cut all large bushes of blackberry to allow sheep to get among the burnt sticks to graze on young shoots and surface-sown grass The cost of blackberry cutting is approximately £2 10s. per acre.

(3) Sow up to 12 lb. per acre of a grass mixture consisting of cocksfoot, danthonia Chewings fescue, perennial rye-grass, crested dogstail, and white clover.

(4) Depending on the season, graze lightly with hoggets about two months after sowing, and increase the stocking until the growth is held. Grasses are not allowed to seed and the young fern and blackberry is nipped off early. The average spring and summer stocking at Manaroa is three and a half sheep per acre up to the end of February. Bought-in hoggets are held on the new blocks and remain there through the winter.

(5) The cheapness of the method is obvious, as country originally carrying one sheep per acre and later reverting to fern can in two years, with an expenditure of 8s. per acre for seed, to which should be added 2s. per acre for sowing, be brought back so that it can do two sheep per acre well. The bought-in hoggets, used solely for secondary-growth control, are sold at a profit.

(6) The method has proved successful for handling fern and blackberry on both sunny and shady faces.

Sheep will not eat either the hard-fern or water-fern, but at Manaroa so far such good burns have been secured that the recurrence of these growths has not proved a problem. The water-fern disappears when its shelter is burned off, and if the hard-fern reappears it can be dealt with by piling rubbish on it and burning it off with a hot fire. Such areas will again be surface-sown with the mixture already specified.

While it is not suggested that the control of fern and blackberry in the Marlborough Sounds is so difficult a problem as it is in the King-country and various other parts of the North Island, the general conditions in both places are somewhat similar, and the experience of the Harvey Bros. in this important matter is published for the benefit of others faced with this problem. It may be noted that a point of difference between the Manaroa system and general control practice in the North Island lies in the use of hoggets — cattle and grown sheep being required in the North to stand up to the work.

SEASONAL NOTES.

THE FARM.

The Coming Month.

PROVIDED weather conditions are favourable, workers in our farming world are generally very busy during September. Indeed, the farmer who is not faced with more work in September than he can deal with conveniently either is quite fortunate in having his work well advanced or is most likely negligent in regard to operations which deserve his attention. Successful farmers follow two definite rules in regard to September work. They firstly make the best possible use of all available time, but secondly, while they are eager to get on with their work, they do not allow this to lead them to the doing of work when it should not be done on account of wet conditions. At the time of writing the indications are that it will be possible to proceed with spring farming operations with greater freedom than usual.

Pasture-management in September.

An important point in connection with the management of pastures during the spring arises from the fact that, particularly in dry years on poor soils, heavy early spring grazing may do considerable harm and be directly responsible for the increased prominence of daisies and other weeds —a result which it may take many years to remedy. Very heavy early spring grazing also may readily have an adverse influence on the persistency of pasture species, such as cocksfoot, which early develop flowering shoots. Indeed it is probable that the persistency of all valuable pasture plants is decreased by such grazing. It is noteworthy that rosette plants, such as catsear, dandelion, and rib-grass, which are ordinarily objectionable in pastures, are suited better than most valuable pasture species to withstand close grazing in the spring.

The frequency with which transformations involving decrease of cocksfoot and increase of flat weeds occur in our pastures are indicative of how often harmful effects are wrought by unduly severe early-season grazing. Further, a decided advantage from the use of the better strains of ryegrass and clovers is that they are much more capable than are the other strains of a long life, even on heavily grazed pastures.

It needs to be clearly understood that the type of grazing to which the foregoing statements refer is really hard grazing as distinct from desirable close grazing, which is valuable particularly later on in the spring. The proper way of avoiding undesirably hard grazing at this period is the provision of special feed, by the use of which it becomes possible to spell a portion of the grassland. Further, since one may be forced to grazing a pasture to an unduly hard extent in the early spring, it is well to remember that the ill-effect of this practice may to a considerable measure be eliminated by suitable top-dressing with phosphates, together possibly with 1 cwt. per acre of a nitrogenous manure such as sulphate of ammonia. Such top-dressing will tend to restore the vigour of the plants which have been weakened by the severe early grazing.

It is extremely likely that the coming of September will find a portion of the grassland still in need of harrowing. Usually it is very advisable to allow of no delay in the harrowing of pastures in which stock have been fed during the winter. In particular, fields from which it is intended to harvest hay or ensilage during the coming summer should be thoroughly harrowed a short time prior to the date of closing them from grazing. A principal aim of harrowing grassland in September is the proper distribution

of stock droppings, and if this distribution is not satisfactorily effected at relatively short intervals it will become increasingly difficult to avoid patches of rank, unrelished growth during November and December, when usually proper control of the length of growth of pastures is most difficult.

There is often occasion to sow pasture-seed mixtures in September. This is especially true in respect to short-rotation or temporary pasture mixtures, of which rye-grass is the principal component. Generally it is desirable to sow permanent-pasture mixtures without any companion crop, while short-rotation mixtures may well be sown with either oats or barley. Companion crops to young pastures are often somewhat misleadingly termed "nurse" or "cover" crops, because of the impression that they afford valuable shelter to the young establishing plants Actually the shelter which such crops afford is apt to be harmful rather than beneficial, because they tend to shut out supplies of the vitally necessary sunlight and to utilize soil moisture which would be of value to the young pasture. Hence establishment of pastures with companion crops is frequently poor. The more dense and luxuriant the companion crop the more is it apt to smother the young pasture. Therefore it is generally inadvisable to seek a maximum crop of oats or barley with which young pasture is sown down, but is often good practice to sow a relatively small amount of cereal seed with the pasture-seed mixture, frequently 1 to 1½ bushels of the cereal seed will suffice in place of the standard 2 to 2½ bushels Further, the smothering effect of cereals on young pastures sown with them is lessened if the cereal is harvested for ensilage or chaff instead of for grain, which involves cutting the crop at a later date

Details of the constituents of seed mixtures suitable for the production of permanent pastures under various conditions were given in these notes in the *Journal* for February last Over a wide range of conditions the following mixture is suited for the production of a short-rotation pasture of two to three years' duration. Italian rye-grass, 15 lb ; perennial rye-grass, 15 lb. ; red clover, 4 lb ; white clover, 2 lb. : total, 36 lb. per acre.

A popular and suitable seed mixture for the production of temporary pasture of one to two years' duration consists of Italian rye-grass, 25 lb., and red clover, 4 to 6 lb., an acre. When a spring-sown cereal is the companion crop the grass seed may be sown in September, after the cereal which was sown in August is above ground, or it may be sown shortly after the cereal is drilled if this is in September. In the latter case the land should be rolled after the drilling of the cereal; then the grass-seed and probably also fertilizer should be broadcast on the rolled surface and covered by a stroke of light tine harrows.

Valuable aid in the securing of satisfactory pasture establishment may, at times, be obtained from judicious top-dressing. It can be accepted as a rule with few exceptions that the applications of a dressing of superphosphate shortly after the sowing of a pasture mixture will prove worth while. The addition to the super of sulphate of ammonia at the rate of 1 cwt. per acre is likely to prove profitable, particularly if the soil is cold, as probably will be the condition in Southern districts. The extra vigour which such top-dressing serves to give the young pasture plants is likely to make its influence felt for a long while in their production.

Top-dressing in September of fields which have not as yet been treated will prove beneficial. But it becomes a somewhat open question whether greater benefit would not be obtained by delaying such top-dressing until November or thereabouts. The answer to the question will depend on the top-dressing programme which is being followed, on the feed prospects for the coming season, and on labour conditions. If top-dressing is being done twice annually, then an August–September dressing will fit in well with autumn dressings. If the feed in prospect promises to be sufficient

for all requirements up to Christmas, then the case for September top-dressing is weakened. On the other hand, there may be a full programme of summer work in sight to which it would be inadvisable to add any labour of top-dressing.

Generally, fields which are being set aside for hay, silage, or seed production should be top-dressed just before they are closed from stock if they have not been dressed fairly recently. Such fields should also be cleaned up thoroughly and made safe for harvesting equipment.

Special Provision of Feed.

The results secured, not only in the coming season but in the one following that, will be governed to a considerable extent by the way in which farmers undertake special forage provision to supplement the feed from pastures during periods of scant grass-growth. Some general aspects of forage provision which are frequently ignored in actual practice—and this usually with somewhat unhappy results—will require attention in the near future.

One of the principal of these neglected aspects arises from the fact that pastures often fail to meet feed-requirement by stock much earlier in the season than is commonly thought to be the case. For instance, while many farmers are in the habit of devoting all their attention to February feeding difficulties, actually pastures often begin to prove insufficient as early in the season as Christmas, so that there is a period of inadequate feeding to which little attention is given. In dairying particularly it is a period which should receive special attention, for an avoidable fall in production at that stage is reflected detrimentally in the production for the remainder of the season. Some of the most ready means of providing for the initial period of summer feed-shortage were indicated in these notes last month.

A second matter calling for attention is the fact that the most marked feature of the normal summer feed provision is not its deficiency in quantity but in quality. Usually the stock are given access to plenty of feed of a sort which is not the sort that they particularly require. The feed provided in summer is frequently too woody or fibrous, too indigestible, and too poor in mineral matter—three weaknesses which may be summed up by saying the feed is too mature. The remedy is the provision of fresh young or non-woody forage. In practice it is of much assistance to keep the pastures short by means of ensilage production and rotational grazing. Further, special forage cropping should be planned so that the whole of the area devoted to any of the crops which increase in woodiness as they mature should not be sown at one date. The crop should be sown at suitable intervals, so that in succession different portions of it will come to the right stage of growth for feeding, a continuous supply of non-woody digestible feed being thus secured over a relatively long period. This is advisable in the case of such crops as oats, maize, and millet. One of the great merits of roots is their high digestibility, together with the fact that this is not materially influenced by maturity. This largely explains the outstanding value of the soft turnip as a summer forage.

Summed up, to make the summer forage position sound one should plan for a succession of feed containing the minimum of fibre. Much has often been made of the need of succulent feed, which is of value not because it contains high proportions of water but because it is markedly digestible.

It is wise to lay plans to produce feed in excess of requirements; by doing this one is placed in a better position to face unexpected crop failures. Further, a little extra effort is always justified, because it is such a serious matter to be short of feed at critical seasons, while on the other hand a supply of surplus feed may enable one to grasp especially favourable market opportunities, and ordinarily it never need be wasted.

In planning the forage cropping for the season, attention should be given to the requirements not only of the main class of stock on the farm, but also to subsidiary classes such as pigs and poultry on the dairy-farms, together with cows on the farms on which grain or sheep are the main consideration. A great many of the large number of farms on which dairy cows, poultry, and pigs are side lines obtain very poor returns from these, primarily because of poor feeding of such stock Now is the time to consider steps that will remedy this common occurrence.

Crops such as mangels, which require considerable attention, should preferably be located in a position convenient to the homestead, where they are much more likely to receive necessary weeding and cultivation than if they are grown in some out-of-the-way situation

Particularly in the case of high-priced land, in drawing up the programme of forage-production the objective should be heavy yields secured by treating a relatively small area in a thorough manner, in preference to a larger area of lower average yield. Only an area that can be thoroughly cultivated should be attempted, for without thorough cultivation expenditure on good seed and manures is to some extent wasted.

Lucerne and mangels are two crops which should be grown to a much greater extent than they now are. Preparatory cultivation for both should be commenced soon if it has not already been started. In selecting the mangel area it is well to remember that this crop is a heavy feeder, and that hence it should be allotted land which is naturally of high fertility or which has been enriched by the addition of suitable animal manure. Because the mangel is remarkably free from serious ravages of pests and disease, it may often be grown season after season on the same area of land. When it is not desirable to break up grassland this is a distinct advantage. When mangels are to be grown for some years in succession on the one area the land should be freely dressed with farm or artificial manure to maintain its fertility.

A permanent, vigorous lucerne crop is of such value that the area selected for it should be highly fertile Poorly drained conditions are to be avoided for lucerne. If at this stage it is proposed to plough old pasture for lucerne or mangels, one deep ploughing will almost certainly give best results, provided the furrows are turned well so as to bury completely the surface layer. This usually contains a numerous population of weed seeds, which if brought to the surface by a second ploughing, would tend to give much trouble in the subsequent crops.

General Crop Work.

Except where land is too wet, no chance to push ahead with the sowing of cereals should be missed. The references to cereals which were contained in last month's notes are generally applicable to work which calls for current attention.

Land for the potato crop which was skim-ploughed in the autumn should be ploughed deeply about September in preparation for the subsequent cultivation necessary to give a suitable seed-bed At this stage it is well to bear in mind that the potato thrives in a loose rather than in a compacted soil. When the cereal sowing has been done the implements may well be kept busy on land for rape and root crops. By cultivating such land in good time one most readily secures the type of seed-bed which is required—that which is fine from the bottom upwards, as distinct from the fine surface layer of soil underlain by large hard clumps, which forms the seed-bed often obtained when cultivation work is done too late.

It is often well to close up lucerne areas in September in order to obtain an early cut. An early cut is valuable because it removes plants which harmfully invade the lucerne in the spring, and which do not appear prominently in subsequent growth during the season.

Utilization of Feed.

The feeding of stock wholly or almost wholly on roots, which generally is inadvisable, is especially so in the August–September period. When persisted in at this time it may lead to the disorder known as redwater, which has often caused much trouble in districts where farmers have made a practice of feeding with roots alone. The roots should, if possible, be supplemented by hay or chaff

Cows during the early part of their milking-season require feed rich in protein. Short fresh grass fills the bill in this respect, but often in September the available supplies of it are insufficient to meet the needs of the herd. If it is proposed to feed hay or ensilage at this period, importance attaches to the fact that such material made from grass that was at the seeding stage when mown is relatively poor in protein. On the other hand, clover and lucerne hay usually are rich in protein. Hence, such hay should be reserved for use in the August–September period. Failing lucerne or clover hay, the ensilage or hay that was made from the leafiest and youngest pasture should be reserved for this stage. If the grass-supply is poor and hay and ensilage not freely available, it may prove well worth while to feed to milking animals some concentrates which are rich in protein, such as linseed-cake, oats, or bran.

—*R. P. Connell, M.A., Fields Division, Palmerston North.*

THE ORCHARD.

Early Season Spraying.

In preparing the season's spray programme one is guided largely by the results of the previous season's operations, and it must be borne in mind that an infection of disease does not die out with the fall of the leaf, but may confidently be expected to reappear in the following season—perhaps even to a greater extent.

We have not yet reached the stage where one specific can be prescribed for all infections, but each disease must be treated according to its mode of reproduction, method of deriving nutriment, time of development, &c., and the combative measures applied accordingly. The life-cycles of the various diseases are sufficiently well known to make it possible to anticipate their appearance during well-defined periods, for the influences which stimulate the host plant into activity act in a similar manner on the disease, and the visible development of the tree provides a fairly reliable guide to the progress of the invisible parasite. Success will depend upon the timely application of the sprays, the thoroughness of the work, and the use of the correct material properly mixed at the strength necessary to do the work without injury to the tree and, in addition, the maintenance of a system of orchard sanitation by the removal and destruction of dead and diseased wood and mummified fruit.

Advantage is taken of the leafless condition of the trees to apply stronger sprays than could be used during the growing-period, with a view to reducing the existing infection and making conditions unsuitable for the establishment of fresh disease before the next spray is due, the limited effective life of the spray rendering a continuation of the treatment necessary. Although not necessarily an annual spray, the first one is usually an insecticidal oil to combat scale insects, red mite, aphis, the pupæ of moths, &c., and as a cleanser and stimulant to the bark. On stone-fruits it is applied at 1–15 strength during the dormant period, as late as possible, but at least a fortnight before bud-movement, so as not to lessen the adhesiveness of the fungicide which will be required at that time. Some

growers delay the oil spray until petal-fall, when they use a strength of 1–30, but this interrupts the fungicide programme, and lessens the control on brown-rot, &c.

Pip-fruits may receive the oil spray at 1 in 12 or 15 at bud-movement. There is an increasing tendency to apply the oil at a later date, using a lighter concentration as growth increases, but this involves a certain amount of risk of burning and russeting, and at least two weeks should elapse between the use of oil and lime-sulphur. An alternative method is to use lime-sulphur, 1–12, at bud-movement, and oil, 1–20, at green-tip The first fungicide on stone-fruit may be either lime-sulphur, 1–15, at bud-movement, or bordeaux, 8–6–40, for leaf-curl, shot-hole, bladder-plum, &c. If scale or red mite is present the lime-sulphur will be the better spray. At the pink stage, just prior to the opening of the blossoms, lime-sulphur, 1–50, or bordeaux, 3–4–40, follows the second fungicide. At petal-fall it is advisable to discontinue the commercial lime-sulphur and use either self-boiled lime-sulphur, 8–8–50, one of the precipitated sulphurs, or dry mix Dry mix has given good control over brown-rot, but for use in small quantities one of the wettable or atomized products will probably be more convenient. The times of application will be governed by weather conditions ; frequent rains may wash the spray off the tree, but not more than a fortnight should elapse between sprayings.

With pip-fruits the green-tip spray is perhaps the most important in combating black spot. From then onwards spore-discharge commences, and the spray goes on as a barrier to its establishment. Delicious, Dougherty, Brighton, and Ballarat apples may receive bordeaux, 6–4–50, at green-tip, and other varieties lime-sulphur, 1–10 or 12 When the clusters of blossom-buds have separated prior to opening lime-sulphur, 1–35, should be used, and at petal-fall the first combination spray for fungi and insect pests will be lime-sulphur, 1–120, plus precipitated sulphur, 10 or 12, arsenate of lead, nicotine sulphate, 1–800, plus spreader.

For black-spot on pears, after the green-tip application of bordeaux, 6–4–50, sprayings may be carried on at the usual intervals with bordeaux, 3–4–50, with the exception of P. Barry, Winter Cole, and Josephine, which may have lime-sulphur, 1–35, at open-cluster, and subsequent sprays of lime-sulphur, 1–100.

Cultivation.

Where cover-crops are still standing they should be ploughed in without delay. During the process of decomposition of vegetable matter losses of nitrogen take place and the soil is actually less capable of supporting growth than it was before the crop was ploughed in, so that if the ploughing is delayed unduly there is a liability to depression of growth during the most favourable growing-period. Too frequent deep cultivation on thin soils in areas of light rainfall may have an injurious effect on the trees. On such soils root-action is not vigorous, and development is dependent upon close contact between the roots and the moist soil-particles. The creation of air pockets in the vicinity of the roots consequent upon ploughing, or any disturbance of the roots during their period of activity, must have a detrimental result The better practice would be to plough the areas occupied by the roots in the autumn or early winter, and thereafter concentrate on the maintenance of a surface or dust mulch for moisture conservation.

Grafting.

Conditions will be favourable for grafting when there are distinct signs of activity in the stock as indicated by the swelling or bursting of the buds The grafts or scions, having been removed and stored while in a dormant state, will be less advanced than the stocks. One of the main essentials to successful working is a suitable knife thoroughly sharpened to a smooth

even edge. Without this it is impossible to make the smooth even cut required to ensure intimate contact between the stock and the scion, without which the union cannot be effected.

The most satisfactory mode of grafting is by what is known as the whip or tongue graft As it is necessary that the stock and scion should be somewhere about the same thickness the use of this method is limited when working over old stumps, but it can be employed in grafting the smaller branches. The methods more commonly used are the notch and rind grafts. The notch is made by cutting a vertical right-angled notch in the top of the stump, about 2 in long, tapering to a point at the bottom, and just wide enough at the top to accommodate the graft when it has been cut to fit. This provides two surfaces along which the union can take place, and a satisfactory join results. It is necessary that the two inner barks should be in contact, and the graft is held in position by the aid of one or two panel pins and binding

The rind graft has the advantage of being easier and more rapidly executed. The stump having been freshly cut down to the desired height, a perpendicular cut is made in the bark from the top edge and extending about 2 in. downwards, and with a slight twist of the knife the bark is slightly raised on one side to facilitate the insertion of the prepared scion. A long slice is cut from one side of the lower end of the scion, tapering to a point like a wedge. A thin slice is run off the side which will be against the undisturbed bark, and the scion is ready for insertion. It is then pushed down to the full extent of the cut surface, pressed firmly up against the wall of bark, and held in position with one or two panel pins.

In all grafting it is essential that the cut surfaces should be in close contact, and to this end the parts are tightly bound with raffia or other suitable tying-material, after which the graft is painted over with hot grafting-wax to exclude air and moisture, and the top of the graft similarly treated. The raw surfaces where limbs have been removed and the tops of the stumps should be painted with wax, tar, paint, or any suitable substance, as a protection against fungi and to assist healing over. In cutting the graft, which need have no more than three eyes, it is advisable to have one eye as near the bottom as possible, and the top eye should have an outward tendency.

Grafting-wax may be made by mixing 2 lb. of beeswax, 2 lb. resin, and ½ pint of linseed-oil, heated together until the wax and resin are completely dissolved. If too stiff when melted add more oil. This wax must be applied hot, but overheating, by making the mixture too thin, is not economical and may burn the bark.

Manuring.

Spring applications of sulphate of ammonia, nitrate of soda, or other nitrogenous fertilizers may be made as growth commences. Overfeeding with nitrogenous manures may upset the balance in fruiting trees and develop the vegetative tendency to the detriment of fruit-production, but as a stimulant in early spring such fertilizers have effect if judiciously applied.

Citrus-culture.

Planting.—Early September is usually the most satisfactory month for planting citrus-trees. Providing the soil conditions are satisfactory, the increasing warmth and brighter days will stimulate the young trees into action, and they should be well on the way to becoming established before the dry weather sets in.

In common with other trees, citrus require a certain amount of pruning at planting or before the expiration of the first year if a desirable type of tree is to be formed. Most young orange and lemon trees as sent out

from the nurseries have a head consisting of numerous shoots of varying strengths, but without much semblance to orderly arrangement. If permitted to develop unaided, in the course of time some limbs will assert themselves and ultimately form a framework, but in the process much valuable tree-energy is wasted in wrong directions, and the grown tree does not lend itself to economic handling. The first consideration in starting a young tree should be to secure an adequate length of stem. Considering the drooping nature of the growth and the hand labour necessary to cultivate under the branches, up to 2½ ft. would not be too high, but as this may be unattainable the alternative will lie in thinning out the weakly shoots and stimulating two or three well-spaced ones, in order to raise the head to the desired height before anything in the nature of permanent branching is permitted. Lemon-picking is a slow business, but it can be considerably facilitated if some system of orderly arrangement of the limbs is carried out while the tree is young.

In planting the hole should be considerably larger than the ball of earth surrounding the roots, and deep enough to allow the lower soil to be replaced with good surface-soil. If dry the ball of earth should be thoroughly soaked in water immediately before planting, and any long protruding roots spread out in the hole. Generally it will be found that if the top of the ball is about 2 in. lower than the surrounding surface the tree will be planted at the right depth. Two or three handfuls of blood-and-bone manure may be dusted in when replacing the soil, which should be loose and friable and well trodden to firm the tree and exclude air pockets, except the top 2 in. or 3 in., which should be left loose.

Pruning.—This operation should be pushed on before the spring growth commences. The presence of a certain amount of fruit will hamper operations, but the prospective young growth and blossoms will benefit. Oranges, mandarins, and pomeloes will require mostly thinning of light growth, partly to reduce the succeeding crop and partly to improve the quality by increasing the amount of light and sun. Lemons, with their different habit of fruiting, will require more detail work in cutting out old, diseased, or exhausted fruiting-twigs, opening up the tree, and stopping or suppressing undesirable shoots. In the production of commercial fruit of good type the elimination of the old fruiting-wood is an important item. This is usually found in the least accessible part of the tree. The fruit, if any, produced on it is of poor quality, and its presence is more detrimental than beneficial. The best fruit is produced on comparatively light twiggy growth inside the tree, and its position is not conducive to long life. The most productive type of wood is that of the somewhat crooked horizontal laterals, and in pruning these are maintained and the shoots approaching the perpendicular are removed, cutting as close as possible to their point of union with the larger branch so as not to leave stubs to die back. Systematic thinning of the light brush will reduce the quantity of cull fruit, render disease-control easier, and greatly facilitate picking-operations.

Cultivation and Manuring.—Cover-crops should be ploughed in without delay, and manuring proceeded with. Blood-and-bone may be supplied to bearing trees according to condition, at from 1 lb. to 5 lb. per tree broadcast, and preferably disked in before ploughing. Nitrate of soda or other quick-acting nitrogenous manures give best value when applied at the time of the main blossomings. The principal requirements of lemons appear to be mainly nitrates (with a large proportion in bulky form as supplied in leguminous cover-crops), some phosphates, and occasional liming to counteract any acidity arising from green manuring and for the formation of nitrates by the nitrifying bacteria.

—*G. H. McIndoe, Orchard Instructor, Dunedin.*

POULTRY-KEEPING.

Hatching-time.

ON all poultry-plants, whether large or small, the aim at the present time should be to get every possible chick hatched out by the end of September, or early in October at the latest. It should be remembered that if chickens are to thrive and return a maximum of profit they must be well over the brooder stage before the hot summer weather sets in. The production of late-hatched stock is the weak link on many unsuccessful plants, and therefore one cannot emphasize too strongly the importance of hatching the young birds at the right season and also of giving them the best of attention from first to last.

The Male Breeders.

In last month's notes some advice was given in regard to the care and management of the breeding-birds, and too much importance cannot be attached to this phase of the operations. It is particularly important, now that the season is advancing, to keep a careful watch on male birds, for it is quite common for a good cock who is too attentive to the hens by allowing them to have the greater bulk of the food to decline in health, with the result that a high proportion of infertile eggs will be produced, as well as others containing weak germs. It is a good plan, therefore, to frequently handle the male birds, and if any are found which are not in the very best form they should be taken out of the pen and fed by themselves or be replaced by others. Strong chicks imply strong germs, and strong germs come only from healthy vigorous breeding-stock.

When a male bird has to be taken out of the breeding-pen for the reason given it is a mistake to put him by himself, as he will eat better and come back to a breeding condition much more quickly if given the company of one or two hens Many of the failures in the work of hatching chicks are put down to incubators, whereas the fault is often traceable to the breeding-stock. Generally with eggs containing the desired strength of germ, and with the improved incubators now available, together with the increased knowledge as to their working, the securing of at least a fair hatch is generally assured.

Brooding Points.

No hard and fast rules can be laid down in regard to handling brooder chicks. If success is to be achieved the individual concerned must study out things for himself. In other words, it is on strict observance of the many little details connected with this important work that success largely depends. The first essential is to prevent chicks from becoming chilled. Chill, with its resultant evil effects, is responsible for more brooder losses than practically all other causes. It is not to be inferred, however, that insufficient provision of warmth is the chief cause of chill; on the contrary, overheating is more responsible for trouble in this respect. It stands to reason that if the chicks become overheated by night they will be particularly susceptible to chill immediately they leave the brooder in the morning. Therefore it is especially necessary to take climatic changes into account and to amend the methods of management accordingly.

It should be remembered that the slightest mistake made, especially during the early stages, cannot be later rectified, and trouble is almost sure to follow. For instance, if chicks become chilled bowel trouble soon appears. Once this disorder sets in little or nothing can be done, and it will generally pay in the long-run to destroy the whole brood of chicks rather than try to doctor them. Most of the troubles in connection with rearing brooder chicks are due to neglect of some essential detail.

Feeding Experiments.—While proper temperature and ventilation are among the chief factors in rearing brooder chicks, the matter of providing

the right class of food must not be overlooked. The main point is to feed nothing but sound wholesome food. There are numerous mixtures that will give good results, many of which have been tried at the Wallaceville Poultry Station. The results obtained show that the manner in which the food is supplied is almost as important as its quality. In one experiment two lots of chicks bred from the same parent stock and hatched in the same incubator were placed in different brooders of similar make. Both lots of chicks received the same class of food and similar detailed attention in all respects, excepting that the first lot was provided with five meals a day over the period during which the experiment was conducted—five weeks—whereas the second received four meals for the first ten days and three meals for the remainder of the period From observations made, Lot 2 through all stages of the experiment showed by far the most vigour and from all view-points developed into better stock than was the case with Lot 1; in fact, these chicks were constantly on the move and gave every indication of possessing good health and sound development, while the mortality which took place was practically negligible. On the other hand several of the chicks in Lot 1 died, while others were destroyed owing to the impaired condition presented and general failure to thrive. From the outset the chicks in Lot 1 were decidedly sluggish, and were inclined to mope under the brooder even on the hottest days, nor did they take the necessary exercise to ensure proper development. The experiment goes to show that, apart from any particular ration provided to brooder chicks, they should be kept more or less on the hungry side during the early stages of their development; otherwise they are apt to suffer from digestive and other troubles as a result of not being encouraged to take plenty of exercise, which is an all-important essential for their welfare

The value of fresh skim milk for young chickens has also been demonstrated at the Wallaceville Poultry Station. During last season some lots of chicks were given milk to drink, while others were supplied with water. In all cases the milk-fed birds made by far the better development; indeed, the best chickens that were reared during the season received nothing but milk during the whole of the brooder stage. Results also indicated that it is a mistake to supply sweet milk one day and sour milk the next, as this is apt to bring on bowel trouble. Personally, the writer prefers it to be sweet at all times where young chickens are concerned.

Cleanliness.—If any requirement should be emphasized more than another in connection with rearing brooder chicks it is that of cleanliness, to prevent the chicks becoming infested with parasitic life. This necessitates the frequent removal of droppings and the spraying of the quarters with a reliable disinfectant. Unclean quarters are bad enough in themselves, but when this is accompanied by overcrowding failure to rear the young birds is almost sure to result. It should never be forgotten that it is more profitable to rear a few chicks properly than many indifferently.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Early Season Examination of Colonies.

WITH the advent of warmer weather advantage should be taken of the fine days to make a preliminary examination of the hives. Provided that the colonies were queen-right in the autumn and had ample stores for the winter period, very little harm can come to them during the opening months of the spring. It is not sufficient, however, to conclude that all is well because the bees are flying freely and numbers of them are carrying pollen into the hives. These activities obtain even up to the point of starvation, and if taken as a guide to the condition of the hives may end

in wholesale losses. To ensure, therefore, that all is well and conditions right for their progress a critical examination should be made as early as possible. Although it is an advantage to postpone the spring examination until the bees are working fruit-bloom and early nectar plants, if it is thought the colonies need attention the work should not on any account be delayed. It must be remembered that the drain on the stores is enormous once brood-rearing has commenced. Everything should be in readiness before opening up the hives. The smoker should be going well, and the beginner would be well advised to protect himself with a good bee-veil properly adjusted.

Breeding.

Normally in September colonies should have a good quantity of sealed brood. If, however, the absence of brood is noted the indications point to a poor queen or that the hive is queenless. To attempt to carry such colonies through the spring months will lead to serious trouble, as they stand in danger of getting robbed out. It is a far better plan to unite such colonies than run the risk of disturbing the whole apiary. A simple method of disposing of weak and queenless hives is to unite them with strong ones, and this may be carried out by placing a sheet of newspaper over a strong colony and putting the hive to be united on the top of the paper. In the course of a day or two the hive may be examined to see that the colonies have united. Should the paper be intact it must be torn in several places, when it will be found in the course of a few days that the colonies are working peaceably. It is essential that breeding should be kept steadily going, so that the colonies will be strong in young bees to take advantage of the first flow of nectar. Food and warmth are important factors in inducing breeding, and these must have the constant attention of the beekeeper during the spring months.

Food-supply and Feeding

As already indicated, the spring is the most critical period of the year for the beekeeper, and the success or otherwise of the season's work will depend almost entirely upon his efforts to guard against the losses attendant upon starvation. Large losses occur annually through neglect in this direction. When breeding is in full swing a considerable amount of food is used up daily for feeding the brood; and, unless the weather conditions are favourable to enable the bees to work the early spring blossoms, it is essential that the food-supply be augmented. The amount of nectar gathered when the weather is favourable, in conjunction with their stores, will tide the bees over long periods, but if bad weather follows, colonies will often be reduced to a state of starvation before the owner is aware of their condition. If on examination a colony is found with insufficient stores to meet requirements preparation should be made to feed at once. It is not a safe policy to keep a colony at starvation-point, as this will prevent the rearing of a succession of young bees to take the place of the rapidly dwindling number of workers at this period.

There are many feeders on the market which can be utilized for the purpose of supplying food. The division-board feeder is the best to use at this season, as it will serve the double purpose of feeder and division-board in cases where the colony is not strong enough to occupy all the frames in the hive. When making an examination of a hive to note its condition the feeder should be placed in the hive in readiness if it is anticipated that artificial feeding will have to be resorted to at a later period. All feeding should be carried on within the hives. Especially guard against feeding at the entrances, as that will surely produce trouble. Place the feeder on the warm side of the hive, and in cases where the clusters are small the feeder can be inserted in position next to the cluster.

A point to remember in connection with feeding is that it creates an artificial flow and is stimulating, and, when started, it must be carried on

until a natural flow from the fields sets in. If there is a suspicion of disease in the apiary, do not attempt to feed honey. In any case it is not wise to use honey taken from another hive, as it is impossible to be sure of its source. Feed only the best white sugar. It is a good plan to feed in the evening, as the discovery of the syrup excites the bees, and the colony has time to settle down before the morning, and there is less likelihood of the other colonies learning the cause of the excitement. A syrup composed of two parts of water to one of sugar, fed slightly warm, will prove the best artificial feed for bees in the spring.

Detection of Foul-brood.

As suitable weather permits, every hive should be opened, one at a time, and a strict examination made for symptoms of foul-brood. If it is present, do not fail to mark colonies for treatment. Mild cases can be treated at a later period in the season, but if a colony is badly affected it is by far the safest plan to sulphur the bees and remove the combs to a place of safety. These combs can be converted into wax when a sufficient number warrant the undertaking. If isolated capped cells are discovered, these should be treated as suspicious Healthy brood-cells are convex in form, bright in appearance, and in contrast differ greatly from diseased cells. These latter are slightly darker, concave in form, and are frequently perforated. Diseased cells of last season's production are usually so shrunken in appearance as to be easily detected, whether they are in an isolated position or surrounded by healthy brood.

Precautions against Robbing.

Every precaution must be taken to prevent robbing getting a start in the apiary. Robbing may be caused by exposing combs too long when manipulating the hives, by careless feeding, and by the presence of weak and queenless colonies. These latter should not be tolerated, and the other causes can be obviated by care and attention. On no account should combs be exposed for long intervals, and if feeding has to be undertaken it should be deferred until late in the day. The excitement caused by feeding attracts other bees, and once they have tasted of the forbidden sweets they will continue to molest the hives for many days. As soon as robbing is detected it is far the best plan to postpone all operations in the apiary, and the entrances to the hives should be contracted at once. If a colony is in danger of being robbed it may be saved by piling wet grass in front of the entrance. Robbers are less likely to enter a hive so protected. Very little trouble, however, will be experienced by robbing if it is not allowed to get a start; prevention is the best plan in all cases. On no account spill syrup near the hives; do not leave combs lying about; and try to avoid weak and queenless colonies. One will then not be troubled with robbing.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Management of Tomatoes under Glass.

THE success of the tomato crop under glass, whether in houses or frames, depends very much on the management at this changeable season of the year. The plants now should only be watered when it is really necessary, and then the water used should be of the same temperature as the soil. With changing winds and outside temperatures it is difficult to keep the plants warm without sometimes getting them overheated, but that is necessary if early fruit and healthy plants, free from disease, are to be obtained.

Plants in frames that are overmoist and kept too close will be affected with "damping-off" diseases. These may not be very apparent until they are planted out, when a number will be found affected with "crown-canker" (*Sclerotinia*), &c., and a number of very unsatisfactory replacements have to be made. On most days some ventilation in the morning may be given to dry up the moisture that has become deposited on the glass overnight, and if the houses or frames are closed again in the afternoon before the temperature drops it should be satisfactory. This treatment is more easily given if the frames are situated in a sheltered, sunny, dry spot, as they should be. On the other hand, a cold draught blowing through the glass-house for a few minutes at this season is very injurious. The plants are then soon chilled, become blue in colour, and growth is checked. They get over it to some extent with a little nursing, but time is lost and very often the bottom bunch of fruit also. The season so far has been unusually changeable, and it will be advisable in some districts to be ready with a little emergency heating for the glasshouse that is usually unheated, if a severe cold should threaten. If such weather occurs while the frames are in use they are easily protected by covering them with mats, &c.

Outdoor Tomatoes, Berries, &c.

Land for the outside tomato crop should be ploughed and prepared for planting out towards the end of October. Take advantage of dry weather to do this, and follow it up with light cultivation to destroy seedling weeds.

Berry bushes and plants should now be in good trim for another fruiting season. Light hoeing in fine weather will be their chief requirement.

Egg-plants and peppers are salad fruits which are being increasingly appreciated. Growers in the warmer districts might very well give them more attention. They should be sown now in boxes under glass.

Market-garden Work.

Seasonable sowings are lettuce, radish, spinach, turnips, and similar quick-maturing crops for any areas that may be available for a short period; also main-crop carrots, beet, and peas; and seed-beds of summer cabbage and cauliflower. Towards the end of the coming month in warmer districts dwarf beans and vegetable marrows may sometimes be included.

A piece of cool moist land should be prepared and reserved for sowing next month seed-beds for winter crops of leeks, celery, cauliflower, broccoli, and savoys.

The main work otherwise will consist of light cultivation and hoeing to destroy weeds. If this is attended to promptly during intervals of bright dry weather a great deal of labour is avoided. Thinning also is an expensive operation that may be greatly simplified by sowing crops with more judgment. They should be sown as thinly as possible. Most of us make the mistake of wasting seeds and making work by sowing these crops much too thickly.

The Home Garden.

Many spring-flowering shrubs in this section would be greatly improved and give a better display next season if they were given a little pruning attention now. Acacias and shrubs which flower on the young wood, such as forsythia, weigelia, and lilac, should have the wood which has flowered cut back to the buds at the base. The desirable young growth is then increased in quality and quantity. Heaths also would be benefited by having the dead flower-spikes removed.

House plants requiring to be repotted should now receive attention. The pots used should be quite clean; if they are new they should be soaked in clean water and allowed to dry superficially before they are used.

—*W. C. Hyde, Horticulturist, Wellington.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FIR AND PINE TREE TRIMMINGS FOR SHEEP.

"INQUIRER," Rangataua :—

An article recently appeared which stated that there was considerable medicinal value in trimmings from Douglas fir when fed to sheep. I would be glad to know to what extent this is correct, and also whether *Pinus insignis* would be as good.

The Live-stock Division :—

It is a common belief among sheep-farmers that trimmings from pine trees have a beneficial effect on the health of young sheep. The medicinal value, though small, is attributed to the turpentine these pine trimmings contain. Several farmers have been using pine trimmings for hoggets affected with parasites with variable success. The small amount of turpentine contained in any variety of pines has a very questionable medicinal value as a cure for parasites, and cannot be recommended to replace other agents of proved reliability. *Pinus insignis* should be equal to Douglas fir in its turpentine content.

TOOWOOMBA GRASS.

"FARMER," Hastings :—

In your April number you give a description of *Phalaris tuberosa* L. (Toowoomba grass, Harding grass) Would you kindly let me know if it is possible to secure a small quantity of seed of this grass, and would it be suitable for sowing on light, dry land with a shingle subsoil How does it compare with paspalum ?

The Fields Division :—

You would probably experience difficulty in purchasing seed at the moment in New Zealand. So far as we know there is none in the North Island. Mr. G. Craw, Linton, produces a quantity of seed annually, but last season this was all exported to Australia. *Phalaris* is not suited to light, shingly country, but requires a good, heavy, fertile type of soil. It cannot be compared with paspalum very well, as the latter requires heat and produces its maximum in the hot weather, whereas *Phalaris* produces its maximum in winter. It has been noticed growing vigorously in North Otago during heavy frosts.

TUNG-OIL TREES.

"SUBSCRIBER," Manutuke :—

Kindly inform me where I could obtain seeds of the tung-oil nut tree — if suitable for this district—and other information for growing

The Horticulture Division :—

Seed of the tung-oil tree (*Aleurites Fordii*) was introduced into New Zealand by the Department of Agriculture a few years ago, and the trees planted out at Te Kauwhata Horticultural Station are now entering their third year. Growth so far has been good, but it remains to be proved if they will crop satisfactorily. It is possible the tree could be grown profitably on some of the poorer soils in the Gisborne district, but the tests now being made will go a long way in giving a good indication on that point. A firm in China offering seeds for sale is Messrs. Drysdale and Co., San Chia Wan, Nanking, China. They state: "The amount usually purchased is 250 lb. *Aleurites Fordii* and 250 lb. *Aleurites Montana*; this is to ascertain which seed is most suited to the climate. The average price is approximately 45 cents ($0.45) Chinese silver currency (approximately 8d. sterling or 15 cents U.S. gold) delivered Shanghai, to which should be added about 20 per cent. for freight and charges to destination."

SEEDING OF SUBTERRANEAN CLOVER.

"R. M. S.," Winchmore :—

I purpose sowing some subterranean clover this coming season, and would like to know if it is likely to seed itself under intensive grazing conditions. I notice that under such conditions the sheep allow very few white-clover flowers to ripen seed, and I would like to know whether the same would apply to subterranean clover.

The Fields Division :—

Considerable interest is now being shown by farmers on the lighter types of soil in the establishment of subterranean clover. If the seed is sown in the autumn and the plants are not too heavily grazed the first season there is generally a considerable amount of seed produced The seed is buried in the soil by the plant, and in places where it was sown two or three years ago the grazing of sheep does not appear to have greatly interfered with the seed-production of the plants and the renewing of the pasture annually by means of seedlings.

UNTHRIFTY STONE-FRUIT TREES.

"NEW CHUM," Enfield :—

Could you tell me why my apricot and peach trees do no good. Every spring they just ooze clear gum from where leaves should come, and then turn black There are only a few leaves on ends of twigs, and the rest of the branches are almost dead. The trees are five and six years old. Apricots, Oullens Early and Moorpark; peaches, Red May and Royal George.

The Horticulture Division :—

From the description given of your apricot and peach trees, they are evidently affected with fungous disease such as leaf-curl, die-back, or brown-rot. In any case they should be well sprayed with Bordeaux mixture as soon as the buds commence to move, and later during the summer with atomic sulphur or lime-sulphur. Before doing this the trees should be pruned, carefully cutting out all dead wood and shortening back the remainder rather hard, being careful to gather and burn the clippings.

BUCKWHEAT FOR BEES.

D. H. BURNS, Napier :—

Having heard lately of beekeepers in the Nelson District for some years past providing a patch of buckwheat for their bees, I should be glad to know if the Department of Agriculture has had experience in this respect, and, if so, with what result Also, if helpful, where could buckwheat-seed be obtained in small quantity suitable for sowing in a small home orchard?

The Horticulture Division :—

Buckwheat is a crop of only secondary importance and has been little grown here. Small experimental plots have done well, but the commercial prospects for the crop have not been good If you desire to try the crop seed may be obtained from Messrs Yates and Co., Seedsmen, Auckland. A small area is not likely to increase the honey-crop very appreciably. The advantage in this respect is obtained only when buckwheat is generally grown on the farms of a neighbourhood.

The Piripiri Parasite.—At last month's meeting of the Research Council the chairman stated that another attempt to introduce *Antholcus*, the piripiri parasite, from Chile, had proved only partially successful, the insect apparently requiring special care in transit. Dr. D. Miller, on his return to New Zealand via Chile, is to take a large consignment under his personal care in a further attempt to effect acclimatization.

WEATHER RECORDS: JULY, 1930.

Dominion Meteorological Office.

GENERAL NOTES.

JULY, 1930, will be remembered for the very cold weather experienced, especially during the latter half. Southerly winds prevailed almost continuously, except for a short spell between the 17th and the 19th, and frequently reached gale force. Hail showers were numerous and widespread. The high country, also, received many falls of snow, which extended on several occasions to parts of the low levels. The falls in general were not heavy; indeed, on the ranges there is less than the usual amount for the time of year. Very seldom, however, has snow been so widely recorded as on the morning of the 28th. Between the 27th and 29th there were comparatively few places south of Auckland, except in Westland and parts of Nelson and Marlborough, which did not receive a few flakes. In many cases it was more than thirty years since snow had been seen previously.

Frosts were naturally numerous everywhere, and from Canterbury southwards there were few nights when they were not recorded. Temperatures were much below normal, several stations having experienced the coldest month on record. At many stations, however, 1895 or 1918, and in some cases 1901 and 1908, were colder.

Rain fell on more days than usual, but in most districts the total falls were considerably below average. The deficiencies were particularly marked in Nelson, Marlborough, and the interior of the South Island. Parts of North Canterbury and the Hawke's Bay, and a few isolated places elsewhere, received rather more than the normal.

During the first eight days of the month the weather, over most of the country, was the finest and mildest that had been experienced for some time. An anticyclone moved on to the Dominion on the 2nd and on the 4th became centred over the southern portion. It remained practically stationary in this position until the 8th, and clear skies and light winds were the rule. Such rain as fell came mainly in the night time. On the 5th and 6th there was fairly general rain, with many heavy falls in the districts about and south of Auckland.

Between the 8th and the 10th a small cyclone moved in a south-easterly direction past the northern extremity of the North Island. Rough weather was caused in the North Auckland, Bay of Plenty, and Gisborne and East Cape districts, and there were some heavy rainfalls. On the 10th, south-easterly gales reached as far south as Cook Strait.

On the night of the 15th to 16th, while an anticyclone was extending gradually over the Dominion, a slight depression developed over the central part of the North Island, and, passing eastward, was followed by a sudden and unexpected southerly gale. There were some heavy rains about Cook Strait, with numerous hail-showers and snow on the high country.

From the 17th to the 19th occurred the only spell in the month during which northerly winds prevailed. These were associated with a deep depression of the westerly type which moved eastward from Tasmania. Strong southerly gales and low temperatures followed on the 20th. On the 21st a cyclone developed from a secondary depression to the one just mentioned, and moved across the North Island to the Bay of Plenty. Southerly gales again set in on the 22nd. Between the 18th and the 22nd general rains fell, and the North Island, especially the eastern portions, recorded many heavy falls.

From this time onwards barometers remained low to the east of New Zealand while to the west they were high. Very disturbed conditions prevailed over the Pacific Ocean. Cold temperatures persisted, with frequent hail or snowfalls in some part or other of the Dominion. Southerly gales blew at intervals from the 25th to the 29th. On the 25th and the

28th they were particularly severe, and on the 28th occurred what was perhaps the most extensive fall of snow ever recorded in the Dominion. The amount was, however, in most places only small

RAINFALL FOR JULY, 1930, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia ..	2·45	17	0·78	5·96
2	Russell ..	..	..	..	4·97
3	Whangarei	4·83	20	1·37	7·26
4	Auckland	3·49	23	0·66	4·98
5	Hamilton	5·62	17	2·76	5·02
5A	Rotorua	2·82	13	0·60	4·89
6	Kawhia ..	4·17	17	0·77	6·16
7	New Plymouth ..	6·00	18	1·94	6·29
8	Riversdale, Inglewood	6·61	21	2·03	9·93
9	Whangamomona ..	4·73	12	1·78	7·35
10	Eltham ..	2·74	14	0·66	5·55
11	Tairua ..	3·54	9	1·08	5·25
12	Tauranga	8·53	14	2·56	4·86
13	Maraehako Station, Opotiki	1·76	13	0·48	4·09
14	Gisborne	4·07	19	1·35	5·14
15	Taupo	1·84	14	0·55	3·83
16	Napier ..	4·31	19	1·55	3·90
17	Hastings	4·37	17	1·10	3·66
18	Taihape ..	3·21	19	1·02	3·15
19	Masterton	4·29	21	0·93	4·31
20	Patea ..	2·01	14	0·69	4·20
21	Wanganui	2·01	9	0·95	3·52
22	Foxton	2·02	9	1·00	3·09
23	Wellington (Karori Reservoir)	4·16	23	0·66	5·22
	South Island.				
24	Westport	4·91	15	1·62	8·30
25	Greymouth	4·48	12	1·04	7·84
26	Hokitika	4·90	14	0·91	9·08
27	Ross ..	4·65	11	1·20	9·94
28	Arthur's Pass	4·35	2	4·17	11·55
29	Okuru, South Westland	8·61	12	1·58	12·03
30	Collingwood	..	..	..	9·65
31	Nelson ..	0·17	3	0·12	3·49
32	Spring Creek, Blenheim	0·59	6	0·25	3·40
33	Tophouse	2·02	8	0·50	4·79
34	Hanmer Springs ..	2·42	16	0·98	4·59
35	Highfield, Waiau ..	3·01	12	0·68	3·44
36	Gore Bay	2·90	15	0·75	2·84
37	Christchurch	2·93	20	0·77	2·76
38	Timaru ..	0·64	9	0·24	1·93
39	Lambrook Station, Fairlie ..	1·14	7	0·54	2·61
40	Benmore Station, Clearburn	0·61	8	0·27	1·73
41	Oamaru ..	0·52	9	0·18	1·74
42	Queenstown	1·03	10	0·28	2·04
43	Clyde ..	0·19	5	0·05	0·94
44	Dunedin	2·07	14	0·34	3·01
45	Wendon	1·81	12	0·35	1·79
46	Gore ..	2·53	17	0·69	1·94
47	Invercargill	2·76	22	0·40	3·28
48	Puysegur Point	4·95	19	0·75	6·18
49	Half-moon Bay ..	3·61	21	0·51	4·13

—*Edward Kidson, Director of Meteorological Services, Wellington, 6/8/30.*

VARIETIES OF APPLES AND PEARS PASSED FOR EXPORT, SEASON 1929.

THE following particulars of the varieties of apples and pears exported from New Zealand in the past season have been compiled by the Horticulture Division from export certificates. The figures for apples represent 1-bushel cases, and those for pears stand for crates consisting of three trays, each tray containing from 10 lb. to 12 lb. of fruit

Apples.

Sturmer Pippin, 333,038, Delicious, 289,970, Jonathan, 257,500; Dunn's, 101,445; Dougherty, 63,138; Cox's Orange Pippin, 53,426, Statesman, 33,699; Ballarat, 16,623; Cleopatra, 15,819; London Pippin, 10,890, Rome Beauty, 10,268; Lord Wolseley, 9,310; Worcester Pearmain, 8 322; Rokewood, 7,893; Tasma, 5,645; Stayman's Winesap, 5,021, Newtown Pippin, 4,719; Premier, 4,682; Gravenstein, 4,533, Scarlet Nonpareil, 3,838; Granny Smith, 3,538; Salome, 3,198; Pioneer, 2,943; Adams Pearmain, 2,322, Alfriston, 2,074; Spitzenberg, 1,828 Celo, 1,699; Shorland Queen, 1,375; Stark, 1,266; Yates, 1,036, Parlin's Beauty, 1 003; King David, 926; Willie Sharp, 916; Blenheim Orange, 804; Hoover, 622; McIntosh Red, 619; Brighton, 569, Pride of Australia, 521; McMahon's White, 520; Stone Pippin, 498; Boston Russet, 444; Rymer, 435, Brownlee's Russet, 432, Simmonds Winter, 420; Crofton, 376; Baumann's Reinette, 339; McLiver's Winesap, 327; Winter Strawberry, 276; Ribston Pippin, 222, Cornish Aromatic, 173; Senator, 158; Mobb's Royal, 139; Giant Jeniton, 111; Golden Pippin, 102; Glengyle Red, 100; Scarlet Pearmain, 96; Washington, 95; Grooby Dessert, 89, Shepherd's Perfection, 89; Baldwin, 73; American Horn, 68, Edward Lippiatt, 54, Desert Gold, 42; Stansill, 40; Winter Banana, 40; Grime's Golden, 27 total cases, 1,272,824.

Pears.

Winter Nelis, 18,987; P. Barry, 13,012; Winter Cole, 10,328; Josephine de Malines, 3,397; Beurre Bosc, 2,683; Doyenne du Comice, 2,435; Packham's Triumph, 2,269, Keiffer, 1,697; Vicar of Winkfield, 1,297; L'Inconnue, 887; Beurré Clairgeau, 681; Beurré Diel, 565; Glou Morceau, 406, Beurré Capiamont, 240; Harrington's Victoria, 105, Beurré Easter, 86; Beurré D'Amanli, 85; Chaumontel, 49; Madam Cole, 48; Elizabeth Cole, 41; Beacon, 32; Winter Bartlett, 22; Bailey Berg, 21; Giblin's Nelis, 20; Broome Park, 7 · total crates, 59,400.

Control of Red Mite on Apple-trees.—Mr. M. Davey, Orchard Instructor, Mapua, Nelson, reports: "Valuable results have been obtained during the past season in this district by the application of ordinary emulsified red oil at a strength of 1–150. It has been found that the application not only kills the adult insect, it also dislodges the deposits of eggs round the calyx of the fruit. The higher-priced summer oils do not appear to offer any advantages over the less costly winter oils, which do no harm to the fruit at a stage just prior to picking, while the colour of the fruit is brightened and made more clear, with possibly the advantage of oiled wrappers in the prevention of scald on susceptible varieties."

A new price-list giving particulars of supplies available from the Wallaceville Poultry Station has been issued, and may be obtained on application to the Department of Agriculture, Wellington Sittings of White Leghorn and Black Minorca eggs are from 7s. 6d. per dozen, and of White Indian Runner ducks, 10s.; incubator lots, 6s per dozen Day-old White Leghorn and Black Minorca chicks are £1 17s 6d. per 25, £3 10s. per 50, and £6 5s. per 100 Birds suitable for breeding purposes, and laying pullets, are also available Orders (to be accompanied by remittance) and inquiries should be addressed to the Poultry Overseer Wallaceville Laboratory Farm, per Private Bag Wellington.

CERTIFICATION OF SEED POTATOES.

CERTIFICATES ISSUED ON TUBER INSPECTION, JULY, 1930.

Following is a further list of growers whose crops have been subjected to and have passed the final tuber inspection in connection with the system of Government certification of seed potatoes. Intending purchasers are referred to a list in the May *Journal* of growers who had received provisional certificates, giving the acreage and relative cropping-power of each line. Further lists will be published later.

Aucklander Short-top (N.Z. Sutton's Supreme)

Weeber Bros., Belfast.
F. Brundell, Kaiapoi
J. Jellie, Russley Road, Fendalton.
W. E. Martin, E Eyreton R.M D
G. Harris, Milford, Temuka
A J. Rich, Kaiapoi
W. Oakley, Halkett.
D Marshall, Killinchy R M D
J Rouse, Pareora, South Canterbury.
R Barnett, Dunsandel
T. O'Brien, St. Andrews
A D Carroll, Southbridge.

Aucklander Tall-top (N.Z Sutton's Supreme)

Weeber Bros., Belfast.
J Warren, Russley Road, Fendalton, Christchurch
H. S Moore, Box 4, Kaiapoi

Dakota.

H. M Marshall, R.M.D., Weedons.
W A McPhail, Rakaia
W. Gee, Springlands, Marlborough.
W J Crozier, Mitcham, Rakaia.

Epicure.

D. Marshall, Killinchy, R.M.D.
W. Shellock, R.M D., Mead, Rakaia.

Robin Adair.

D. Marshall, Killinchy R.M.D.

Majestic.

A J. Clarke, Rangiora.
C. H. Wilson, Lorneville, Invercargill.

Arran Chief

G. Jones, "Vale Royal," Halswell.

Early Regent.

M. Kelly, 502 Lincoln Road, Halswell.

King Edward.

L. King, Rakahouka, Glencoe, R.M.D., Invercargill

Iron Duke.

H. Hancock, Awahuri, Palmerston North.

Golden Wonder.

J Warren, Russley Road, Fendalton, Christchurch.

GRADINGS OF BUTTER AND CHEESE, YEAR 1929-30.

THE Dominion quantities of butter and cheese graded for export by the Dairy Division during the twelve months ended 31st July, 1930 (the dairy industry year), were as follows:—

Butter: Salted, 93,734 tons; unsalted, 1,610 tons: total, 95,344 tons—an increase of 16·76 per cent. compared with the figures for the preceding twelve months.

Cheese: White, 57,689 tons; coloured, 29,564 tons: total, 87,253 tons—an increase of 0·74 per cent.

In butterfat equivalent the amounts for butter and cheese combined represent a net increase of 10·4 per cent. compared with those for 1928–29, hitherto the peak year. A new high-level record in annual butterfat production has thus been established.

Noxious Weeds Order.—The Castlepoint County Council has declared pennyroyal (*Mentha pulegium*) to be a noxious weed in that county.

EXPORTS FROM NEW ZEALAND FOR YEARS ENDED 30th JUNE, 1929 AND 1930.

Commodity.	Unit.	Quantity.		Value.	
		1928–29.	1929–30.	1928–29.	1929–30.
New Zealand Products				£	£
Butter .. .	Cwt.	1,567,393	1,817,799	12,744,992	13,022,957
Casein .. .	,, ..	46,016	65,928	140,913	192,558
Cheese .. .	,, .	1,661,000	1,675,906	6,889,993	6,361,329
Fish .. .	,,	24,741	22,766	86,077	79,974
Honey .	lb .	2,505,795	607,581	89,241	20,772
Beef, frozen .	Cwt ..	509,738	328,474	808,266	577,120
Lamb, frozen	,, .	1,879,680	2,014,702	6,925,831	6,884,717
Mutton, frozen ..	,, ..	961,247	1,021,146	1,949,919	2,042,301
Pork, frozen .	,, ..	190,740	132,730	589,609	467,475
Other frozen meats	,,	111,185	150,483	229,692	281,282
Beef, salted ..	,,	2,365	2,442	5,284	6,630
Meats, potted and preserved	,, .	53,495	31,758	198,323	143,277
Sausage-casings	lb	3,574,661	4,200,707	688,098	779,651
Milk, preserved	,, .	2,060,813	2,621,990	49,069	56,864
Milk, dried ..	,, ..	16,083,585	10,746,152	361,625	285,837
Peas ..	Cental	143,817	153,311	112,623	101,700
Oats ..	,,	25,466	4,569	13,373	2,323
Apples, fresh	lb ..	32,171,840	56,211,770	447,509	724,595
Hops .. .	,, ..	282,979	314,681	15,942	16,235
Potatoes . .	Ton ..	1,056	1,596	8,298	13,007
Live-stock ..	..	..	..	117,710	121,267
Calf-skins.. ..	Number	741,923	649,783	300,197	201,298
Hides, horse and cattle	,,	355,490	273,914	677,552	374,646
Rabbit-skins ..	,,	11,278,431	8,257,869	555,811	315,198
Opossum-skins ..	,,	152,430	156,675	102,812	102,461
Sheep-skins, with wool	,,	1,179,788	1,207,604	464,303	333,515
Sheep-skins, without wool	,,	8,729,575	9,762,632	1,473,253	1,336,524
Wool	Bale ..	687,833	553,298	15,923,157	8,156,309
Phormium fibre ..	Ton ..	13,620	10,245	371,520	273,778
Seeds, grass and clover	Cwt. ..	55,935	43,955	172,621	167,781
Tallow .. .	Ton ..	21,352	22,118	719,099	686,261
Coal	,, ..	177,343	157,430	247,228	215,568
Kauri-gum ..	,, ..	4,517	4,891	247,094	257,964
Gold .. .	Ounces	120,506	132,313	495,456	544,999
Silver	,,	434,501	512,148	43,288	46,110
Leather	..	..	..	16,206	8,722
Timber, sawn .	Sup. ft.	37,617,329	38,255,654	408,158	426,505
Other products ..	..	..	..	598,265	593,547
Total.. ..	..	..	..	55,288,407	46,223,057
Re-exports ..	.	..	..	956,343	1,365,156
Total exports ..	..	..	..	56,244,750	47,588,213

Commenting on the figures, the Census and Statistics Office states: "The principal cause of the recession in 1929–30 is found in lower wool-prices, the declared value being £7,766,848 less than that for 1928–29, representing a decline of 36 per cent. per bale exported. The quantity shipped receded by 134,535 bales, this decrease, however, being mainly due to the fact that a considerable portion of the clip had not been disposed of at the end of the production year."

The New Zealand

Journal of Agriculture.

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PERENNIAL RYE-GRASS STRAIN INVESTIGATION.

SINGLE-PLANT TRIALS AT THE PLANT RESEARCH STATION.

E. BRUCE LEVY, Agrostologist, and WILLIAM DAVIES,* Plant Geneticist, Plant Research Station, Palmerston North.

PERENNIAL rye-grass, like other species of herbage plants, presents marked differences between individual plants within a line. When rye-grass is grown spaced, each individual having sufficient room to carry on its growth unhampered by competition from its neighbours, one finds that the plants vary in growth-form from very lax and spindly to very dense and bushy. The former produce only small amounts of leafage and much stem and stalk, the latter produce more leafy growth and usually give a much higher total yield spread out over a longer grazing-season. Lax spindly plants are usually short-lived, the dense types are more permanent, and therefore more useful for long-term pastures. In the breeding and selection of pasture forms of rye-grass one has therefore to look to the dense leafy growth-forms for our most useful types.

In any scheme of plant-breeding it is necessary to study the behaviour of individual plants which in the aggregate may make up contrasting types or strains. This can only be done by resorting to spaced plant trials. The single-plant study has two main objectives—firstly, as a means for learning the make-up of a line, and, secondly, as a means of culling and selecting to a type that ultimately may be bred up to form an elite strain.

In our trials when dealing with any number of unknown lots the broadcast plot as a pure sowing under a triple system of mowing has come first. Just so soon as differences in behaviour or appearance manifest themselves in the various lots, single plants are lifted at random from all lots that show between themselves the slightest variation. These planted out as spaced plants to allow of full and unrestricted development determine the character of the individuals

* Member of staff of Welsh Plant Breeding Station, Aberystwyth, seconded to the Plant Research Station, Palmerston North.

which in the broadcast gave rise to those differences. In elite strain building from the best of the lots studied in such trials the single-plant work, which permits of individual culling, selection, and genetical analysis, must of necessity precede the broadcast trial of an elite strain. The third and final test for any type or strain is in the field, on defined soil-types, under competition with other plants and subject to normal grazing by stock. This three-fold test is regarded as constituting a sound system as a basis for herbage-plant improvement.

In this *Journal* for June last the writers submitted the results of the broadcast trials under the triple system of mowing. The present article deals with the second phase of the trials, and sets out results of preliminary single-plant work in regard to perennial rye-grass.

Technique Adopted.

The whole of the lines sown out in the broadcast were classified according to type, defined by eye-differences as to colour, form, manner and rapidity of establishment, growth, and other diagnostic features that showed up early in the seedling stages. Fifty-three lines were chosen, including the main and intermediate types, and from these, while the plants were still in the one, two, or three-tiller stage one hundred single plants were dug up at random, fifty from Series A, and fifty from the duplicate plot of the same line in Series B. Particular care was taken that single plantlets certainly derived from a single seed were used in transplanting. These were planted out as spaced plants in rows 2 ft. apart in the row and 2 ft. between each row. Five rows of twenty single plants per row constituted a plot of each line under test. Between every other plot contiguous to each line for comparative purposes one row of similarly spaced plants was planted of a known type of English indigenous rye-grass. This tested line was supplied by the Welsh Plant Breeding Station at Aberystwyth, and represents a leafy and persistent type from the pastures of Kent, in England.

Using this type as a control had a double advantage in so far as one of the writers has an intimate knowledge of its standards as exhibited under English conditions. It was a known quantity, one might say, while the New Zealand lines were from a type point of view distinctly unknown This principle we are applying throughout the whole of our trial work at the Plant Research Station, including the testing of lines under the scheme of seed certification now in hand.

This preliminary trial with rye-grass, including the controls, involved the planting of 5,600 plants. This was done during August, 1929, and it early became apparent that very wide differences existed in the individuals between one lot and another, showing clearly that eye-differences in the broadcast were essentially due to differences in the nature of the individuals that made up that line. Further than this, not only do the individuals vary between lot and lot, but marked variation exists among the individuals of any one single lot. In the one lot the type may be *dominantly* true perennial, true Italian, or false perennial, but just as in the broadcast plots a classification into types was possible on eye-appearance alone, so that same classification holds

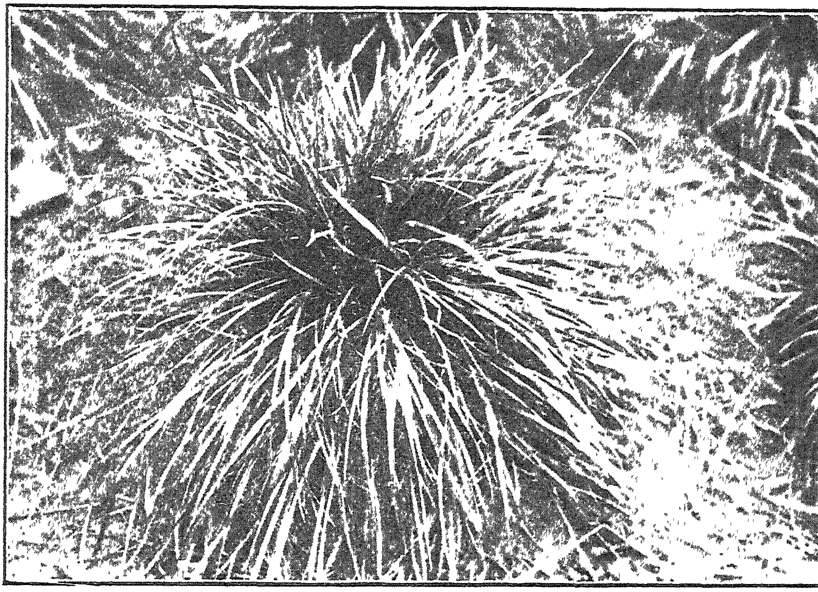

FIG. 1 DENSE LEAFY TYPE OF PLANT.

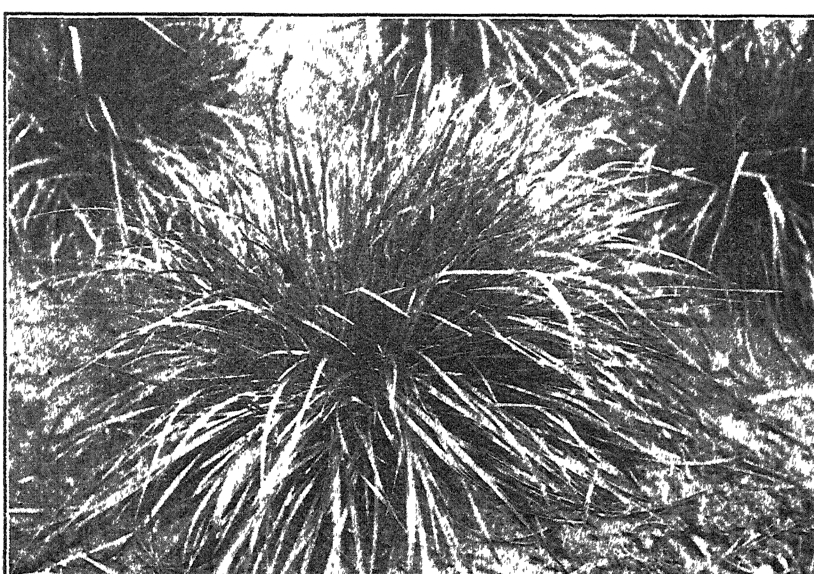

FIG. 2. SEMI-DENSE LEAFY TYPE OF PLANT.

[Photos by E. Bruce Levy.

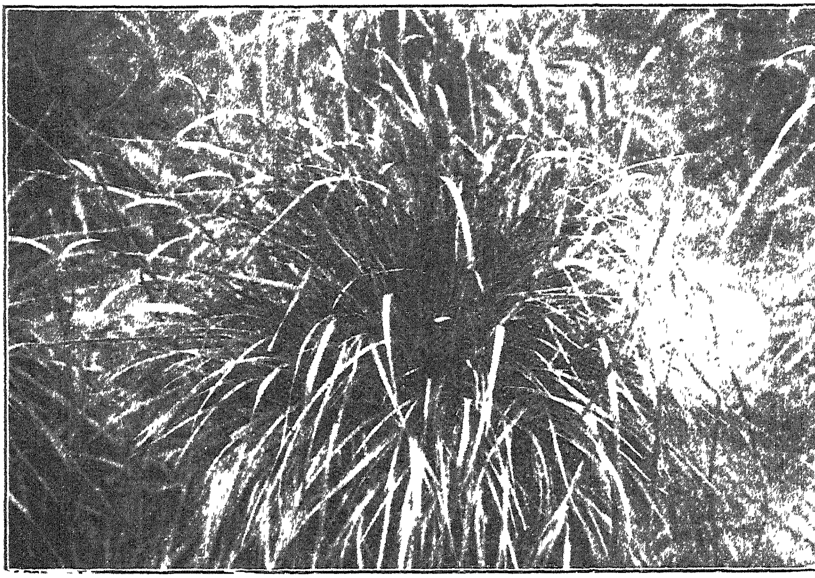

FIG. 3. SEMI-LAX, EARLY FLOWERING PLANT.

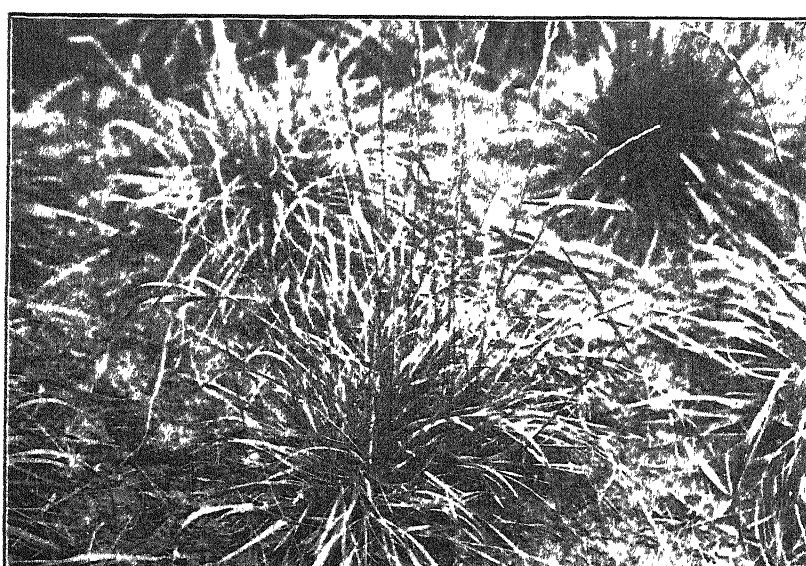

FIG 4. VERY LAX, EARLY FLOWERING PLANT.

[*Photos by E. Bruce Levy.*

in the single-plant study. Jenkin* makes only two groups—" Class A," the perennial end of the series, which would appear to embrace our Types 1, 2, and 3, and " Class B," which would appear to include our average and bad false perennials, Types 4 and 5, and possibly some of our Type 3.

CONSIDERATION OF SINGLE-PLANT ANALYSIS IN RELATION TO TYPES.

TYPE 1: TRUE PERENNIAL RYE-GRASS.

This type is made up of plants dominantly dense-crowned, many-tillered, with stiffly erect leafy shoots, dark green in colour, and contains little or no markedly extraneous types such as definite Italian rye-grass (Type 6) or false perennial of the nature of Types 4 and 5. This is not to say that marked variation does not exist even in the best of the lines coming within this type. Figs. 1 to 4 show four individual plants in a Hawke's Bay line put out as single plants.† Fig. 1 is a fine-leaved, dense-crowned, multi-tillered form essentially of the desired growth-form. Based on our researches we are inclined to the opinion that the ideal type for all-round average conditions in New Zealand will revolve somewhere around this growth-form, and elite strain building is now commencing with plants of this type. Fig. 2 shows a rather coarser type, leafy dense at the crown but hardly as productive as that of Fig. 1 Fig 3 is a laxer plant, freer-seeding, still fairly dense at the crown, and a good producer. This may represent a definite form of a true perennial, but the general build and behaviour of the plant would suggest a trace of Italian in its make-up. Genetical analysis, however, would be necessary to verify this assumption. With our present knowledge we would eliminate this growth-form in mass selection by culling. Fig. 4 shows a low-producing, free-seeding, open-crowned, few-tillered type; while representing a true perennial rye-grass in the morphological sense it is a type that in all probability would be short-lived.

These four growth-forms, all from one line of Hawke's Bay rye-grasses (Ba 3) show how even a good line may vary within itself, and it is rather interesting to speculate on such a line going into an arable district and being repeatedly sown and harvested year after year for seed-production. It is obvious that of these forms those strains shown in Figs. 3 and 4 are the most ready and most early seed-producers, and when sown and harvested time and time again the line must ultimately run dominantly to these types rather than to the true perennial desirable herbage types of Figs. 1 and 2, which are relatively shy seeders (in the first year at least) and run to leaf rather than to stem.

TYPE 2: TRUE PERENNIAL.

Single plants of Type 2 resemble very closely those of Type 1 in being dominantly of the leafy, dense-crowned, multi-tillered true perennial type, but within this group we place lots that are essentially a wider mixture of types--lots that contain traces of Italian rye-grass (Type 6) and possibly odd plants of Types 3, 4, and 5. This

* T. J. Jenkin, "Perennial Rye-grass at Aberystwyth," *Welsh Journal of Agriculture*, Vol. VI, 1930.

† All photographs in this article were taken on 13th January, 1930, and show aftermath recovery thirty-eight days after cutting.

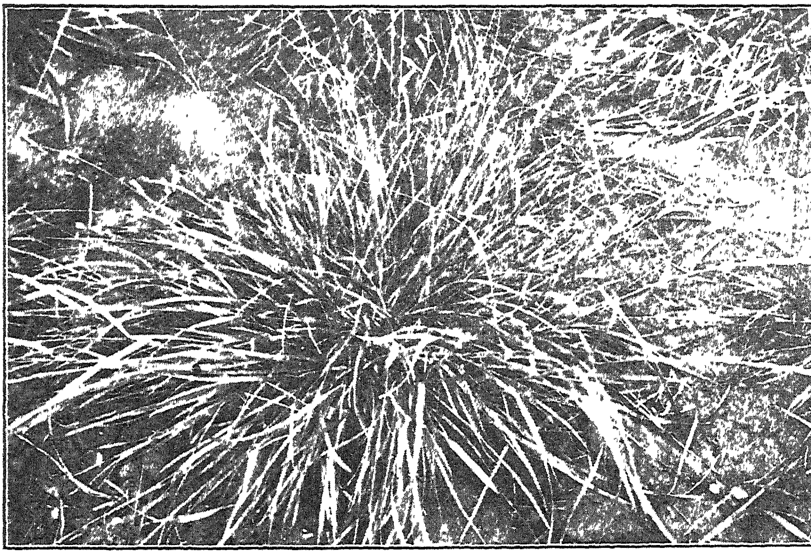

FIG 5. LAX, PROSTATE, EARLY FLOWERING PLANT.

FIG. 6. ITALIAN RYE-GRASS (LEFT), AND SEMI-LAX PERENNIAL (RIGHT).

[Photos by E. Bruce Levy.

admixture imparts to the general broadcast plot a somewhat different shade of colour, and for the most part a slightly more rapid establishment from seed.

TYPE 3 : GOOD FALSE PERENNIAL.

In the single plant this type varies about a common growth-form such as that depicted in Fig. 5. The crown is more open and the whole flattened and spread out or prostrate. The colour of the leaf is paler than that of the true perennial, and there is a laxness of foliage compared with the more stiffly erect foliage of Types 1 and 2. This slightly paler and duller sheen of Type 3 in the broadcast plot is a distinguishing mark for this type against the true perennials of Types 1 and 2. None the less we must regard this type as being a perennial rye-grass, speaking strictly in the botanical sense. Our experiments go to show that as a type it persists fairly well, but fails to make a sward to approach the true perennial rye-grasses of Types 1 and 2. The best of the South Island rye-grasses is represented in this growth-form and type (Fig 5).

TYPE 4 : AVERAGE FALSE PERENNIAL.

This is undoubtedly the worst of the perennial rye-grasses, and represents probably the ultimate state of deterioration that a perennial rye-grass can reach. The crown is open and few-tillered, stems sparsely foliaged, frequently tinted deeply in red, with definite inclination to spread on the ground. Recovery after the first cut or first grazing is extremely poor, and never at any time, excepting possibly in the first three months after sowing, does this type approach the true perennial in production. In single-plant analysis and as a type it is less uniform than the preceding types, and always contains considerable proportions of hybrid forms that approach in some ways toward the Italian parent. This is demonstrated clearly by Table 1, in which on an average 15 per cent. of the single plants of lines of this type under trial show definite and more or less close affinities with Italian rye-grass, and a further 6 per cent. are intermediates showing closer affinities to perennial rye-grass.

TYPE 5 : BAD FALSE PERENNIAL.

Just as Type 4 may be regarded as a degenerate perennial rye-grass at the extreme of the series, so Type 5 may be regarded as a degenerate Italian or admixture of Type 4 crossed with Italian.

Figs 7 to 9 give a very good idea of one set of individuals of Types 4 and 5, and Figs. 10 to 13 of another set found as regular components of these bad false perennial types. Figs. 7 to 9 show individuals that are apparently throw-backs dominantly to the Italian parent. Fig. 7 is dominant Italian in form and behaviour. The foliage is erect, pale-green in colour, and recovery after first cut, as the photo shows, is quite satisfactory. Compared, however, with true Italian (Fig. 6, plant on left) it is not so tall, nor so leafy in general appearance, and is scarcely awned. Fig. 8 shows less Italian character, growth is much less erect, foliage stiff and coarse, with steely-grey colour rather than the pale yellowish-green of the true Italian. Fair recovery is

FIG. 10.

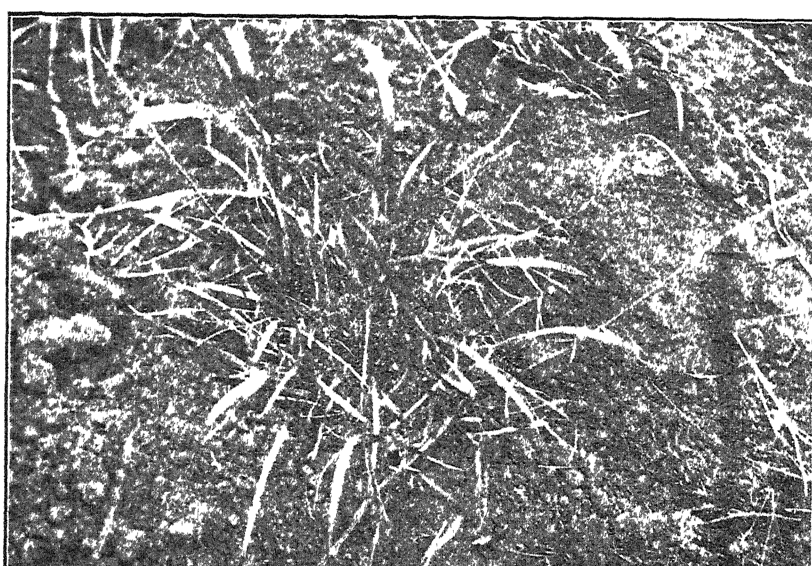

FIG. 11.

INTERMEDIATE TYPES SHOWING SLIGHT RECOVERY AFTER HAY-CUT.

[*Photos by E. Bruce Levy.*

readers will realize the wisdom of going straight to the Hawke's Bay product and starting on material that at least has not undergone hybridization and deterioration to anything like the extent of commercial rye-grass from the South.

These photos show in a striking way the marked state of deterioration that New Zealand commercial rye-grass has come to as a result of years of haphazard, unguided seed-production, and one can almost express by means of these pictures the factors that have largely been responsible for this deterioration. If one carries on from the discussion under Type 1, in which is seen the possibility of disappearance of the leafy shy-seeding true perennials and rise to dominance of the stemmy free-seeding types as a result of continuous reaping and sowing, and then imagines a mixture of Italian rye-grass and these free-seeding stemmy perennials sown and harvested together, and that crop again mixed with Italian and sown out, it can readily be perceived, backed by the evidence presented by Jenkin* that Italian and perennial freely cross, and that these hybrids also freely cross and are themselves fertile. It will also be recognized that such a blending of types must ultimately lead to the hopeless state of certain of our New Zealand rye-grasses wherever this annual sowing and reaping and mixing of species and types has been practised.

TYPE 6: TRUE ITALIAN RYE-GRASS.

Many of the lines offered for sale as perennial rye-grass or simply as rye-grass proved to be straight-out Italian This type is of a pale-green colour, very rapid in establishment, erect in growth, comparatively few-tillered, but producing leaf well up the stems and recovering well after first and second cutting (Fig. 6 plant on left). Recovery of Italian and a true perennial (plant on right) after first cutting may be compared in this photo.

ENGLISH INDIGENOUS TYPE USED AS CONTROL.

The Aberystwyth line used for control plots in this experiment gave rise to very dense plants, and these are considerably finer in the leaf than the dense plants of Hawke's Bay (Type 1). As in the New Zealand Type 1, the tillers were closely packed at the crown and tended to the erect rather than prostrate (compare Figs. 16 and 1). This line has proved to be very persistent in broadcast plots under weekly mowing, but under New Zealand conditions has failed to stand up to normal sward competition, and did not make as much growth during the first two years as the best Hawke's Bay types. This latter evidence is confirmed by the single-plant studies and also by the Aberystwyth trials†. It flowered fourteen to twenty days later than the average dense plants of the best New Zealand rye-grass, but there was considerable variation within the line both in regard to growth-form and date of flowering. Figs. 16, 17, and 18 show some degree of this variation as to type, and clearly indicate that perennial rye-grass even from exceedingly old-established swards may contain many undesirable types that call for elimination in any modern scheme the aim of which is elite-strain breeding.

* T. J. Jenkin: "Artificial Hybridization of Grasses." Welsh Plant Breeding Station, Aberystwyth. Bul Ser. H., No. 2 (1924) See also Jenkin, loc. cit.

† See Jenkin, loc. cit.

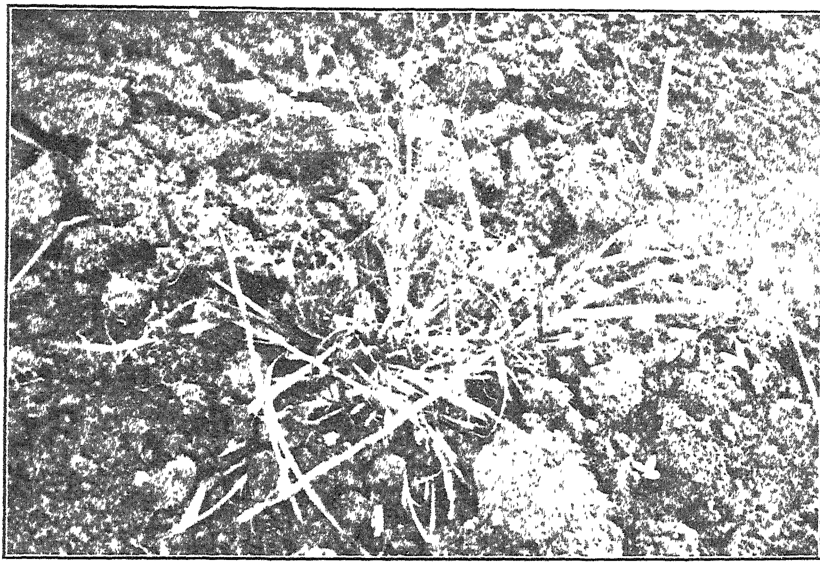

FIG 12.

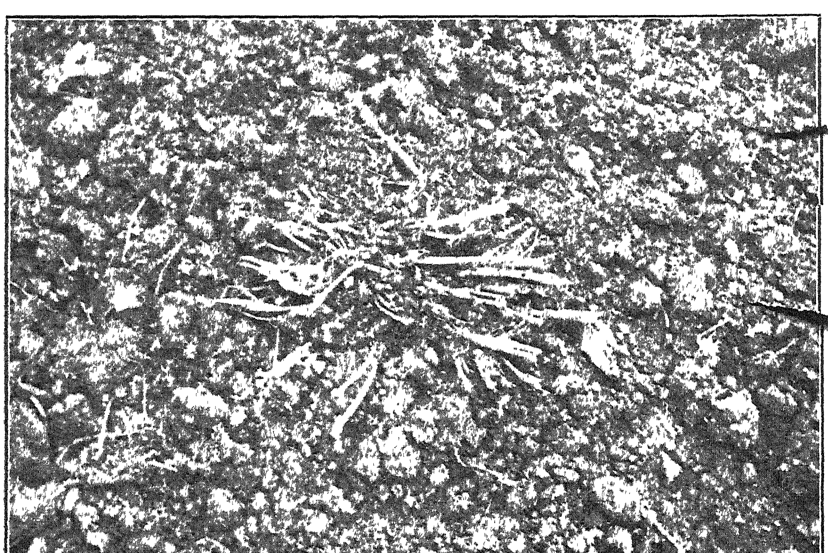

FIG. 13.

INTERMEDIATE TYPES SHOWING LITTLE AND NO RECOVERY AFTER HAY-CUT.

[*Photos by E. Bruce Levy.*

DATA IN RELATION TO RYE-GRASS TYPES WITHIN GROUPS 1 TO 6.

Table 1 gives an analysis of 5,200 single plants based on examination of each plant from the botanical characteristics viewpoint. It emphasizes the mixed nature of the ordinary New Zealand commercial types that exist to-day, and clearly sets out the affinites towards the true perennials of Types 1 to 3, with increasing Italian affinities in Types 4, 5, and 6 The point we wish to stress is that the hybrid with perennial affinities is not so good as the true perennial, nor is the hybrid with Italian affinities as good as the true Italian. Looked at from every angle, it seems that Types 4 and 5 and ultimately Type 3 must be eliminated from the seed-trade of New Zealand and under no consideration should importations of this type of seed be made. We must in future aim at the pedigree true-bred perennial, on the one hand, and the pedigree true-bred Italian on the other.

Table 1.—Showing Affinities of the respective Rye-grasses in Types 1 to 6.

Type No.	Number of Lines under Trial (Single Plants).	Perennial.	Intermediates approaching Perennial.	Intermediates approaching Italian	Italian.
1	24	95*	2	2	1
2	1	94*	1	5	..
3	13	92†	5	2	1
4	7	79‡	6	11	4
5	6	25‡	10	44	12
6	1	..	..	..	100

* Dominantly dense and semi-dense plants of types shown in Figs. 1 to 3. † Dominantly grey, prostrate, or lax plants of types shown in Fig. 5. ‡ Dominantly lax, sparse-tillered plants as in Fig. 4.

RECOVERY AFTER CUTTING.

The single plants were cut back on the 6th December, 1929, when they were all in full flower, with the exception of the line from Aberystwyth, which had not at this date attained maximum flowering. The experiment had unfortunately to be abandoned in February, 1930, consequent upon a lack of tenure of the experimental ground. The hay cut in December was therefore the only crop taken in this trial. All the photos were taken on 13th January to show recovery (thirty-eight days) after the first and only cutting.

When dealing with our broadcast trials in the previous report it was shown that in the aggregate Types 3, 4, and 5 do not recover, nor show vigour after repeated cutting, and that Italian rye-grass (Type 6), while recovering well at first, failed to persist after mid-season. The true perennials of Type 1, however, have in all cases recovered excellently from cutting, and in the majority of cases have made adequate recovery, and have persisted very well under a system of weekly mowing. The single-plant studies have very definitely shown that there is a direct relation between the density of the plant and its ability to withstand repeated defoliation, thus confirming the work of Stapledon at Aberystwyth.

Table 2 shows the relative recovery of Types 1 to 6 at two recording dates subsequent to the hay cut in the spaced plant trial. Growth

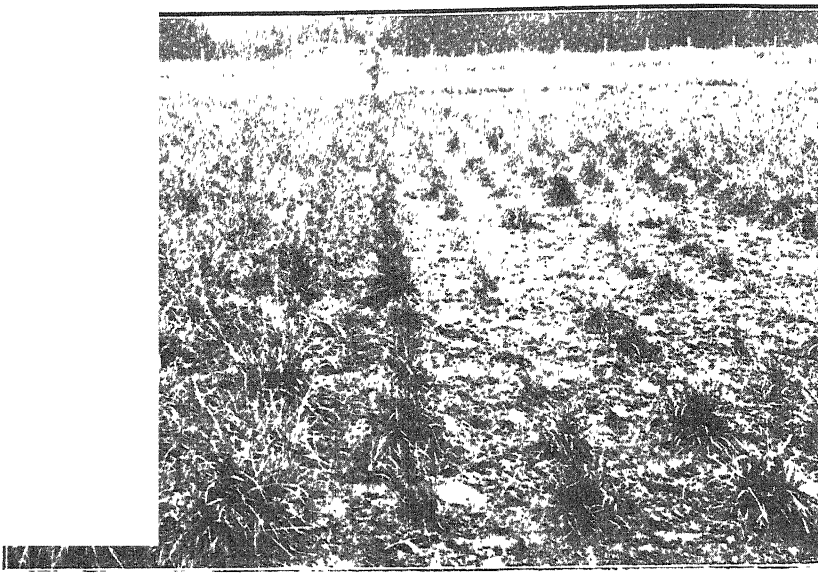

FIG. 14. ON LEFT, NEW ZEALAND TRUE PERENNIAL; IN CENTRE (ONE ROW), ENGLISH INDIGENOUS; ON RIGHT, NEW ZEALAND FALSE PERENNIAL.

FIG. 15. CLOSE-UP VIEW OF PLOT OF FALSE PERENNIAL.

[*Photos by E. Bruce Levy.*

Table 2.—Average relative Recovery after Cutting (Type 1=100 at each Date).

(The only cut was made on 6/12/29.)

—	Types 1 and 2.	Type 3.	Type 4.	Type 5.	Type 6.
Relative recovery at 16/12/29 ..	100	96	60	65	111
Relative recovery at 4/1/30 ..	100	85	63	33	*

* No data.

marks on a scale 0–10 were given each plant at the two dates, and Type 1 has in each case been placed at 100, the other data being adjusted accordingly. Types 3 and 4 in the aggregate did not recover as well as Type 1 even under this very lenient treatment, where competition was nil and after only one hay-cut. Not only did the true perennials recover more quickly, but they maintained a more rapid rate of growth, outyielding Types 3, 4, and 5 by a wider margin at the end of a month than after the first week subsequent to cutting. These data are extremely significant when it is realized that all the plants were under more or less ideal conditions of soil, fertility, and spacing. Competition for light or nutrients must have been all but negligible under the conditions set up in the trial, and yet after one cut, made when the plants were only about nine months old, the false perennials failed to make adequate recovery. Type 5, on the average of 600 spaced plants, made only 33 per cent. as much growth in the month as the average for Types 1 and 2. Italian rye-grass (Type 6) behaved normally and recovered rather more rapidly than the true perennials, and this really goes to emphasize the relative poorness of the false perennial types and especially of the intermediate forms so conspicuously dominant in Type 5. The photographs will serve to emphasize this point.

RUST-RESISTANCE.

Leaf-rust (*Puccinia coronata*) was severe in the rye-grass trials as a whole during the early summer of 1930. There was also a slight attack of stalk-rust (*P. graminis*), but this did far less damage than the former. The relative degree of resistance to rust attack was quite a feature of the plots. In the broadcast trials spring-sown lots of Hawke's Bay rye-grass (Type 1) were particularly marked by their relative resistance to leaf-rust in comparison with Southern (together with imported) seed conforming to Types 3, 4, and 5. The single-plant work demonstrated, furthermore, that the dense leafy types are much more resistant to disease than are the stalky open-crowned forms. Italian rye-grass proper appears to be fairly resistant to leaf-rust, but the less vigorous intermediate forms are definitely susceptible to attack. It is, however, difficult to give reliable figures bearing on this point, since in our spaced-plant trials so large a proportion of deaths and non-recovery occurred among the intermediates following the hay-cut. Rust attack was hardly noticed prior to cutting the hay, and attained its greatest relative severity in early February (1930).

To the plant-breeder the practical outcome of the rust study has been to show that there exist forms of perennial rye-grass which appear to be highly resistant or may be completely immune to leaf-rust, and

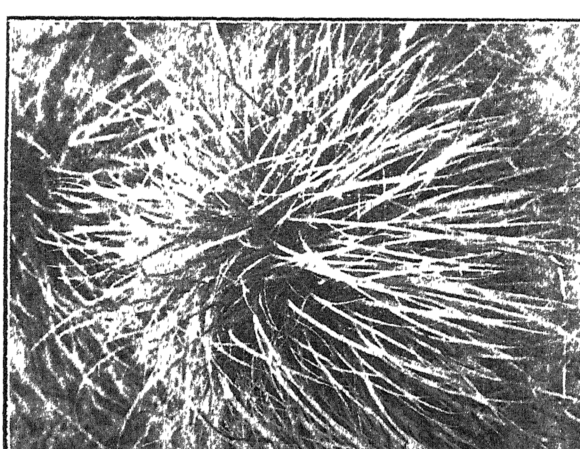

FIG. 16.

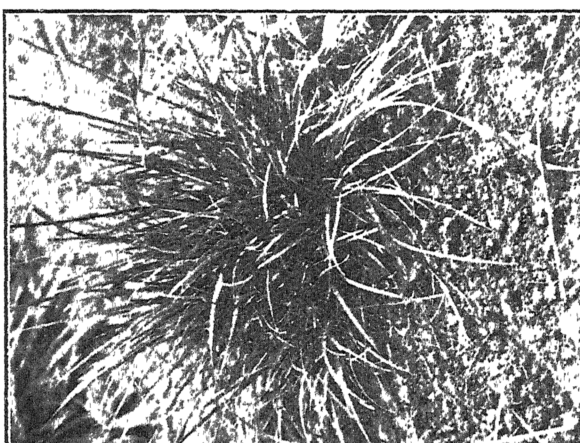

FIG. 17.

FIG. 18.

SHOWING RANGE OF VARIATION IN ENGLISH OLD PASTURE RYE-GRASS

[Photos by E. Bruce Levy.

it is wholly encouraging to find that the most dense growth-forms are those most resistant to disease This means that in the breeding of pasture-plants one may be able to employ quite simple diagnostic characters in the selection of types and the determination of growth-forms likely to be of greater economic value as parent material in the production of improved and elite strains. It also emphasizes that disease-control in rye-grass is a problem for the plant-breeder as well as for the mycologist—the breeding of immune strains of pasture-plants may well vie in importance with similar work that has made considerable advances in regard to the cereals.

The single-plant trials have been decidedly encouraging, and it is now possible to start more intensive studies on the best of our single plants with the hope that these may be used as parent material in connection with economic plant-breeding in general and relative to genetical studies in particular—projects fraught with immense possibilities for the increase and for the betterment of grassland-production in pastoral New Zealand.

CONCLUSION.

In the past in New Zealand emphasis has been laid upon the importance of the species' make-up of a sward, the proper manuring of that sward so as to encourage good grasses and clovers to grow, and the efficient management of the pasture in conformity with the ecological requirements of our major grassland species. Now comes a fourth essential factor—that of strain within the species. One may now regard (1) species, (2) strain, (3) adequate fertility, and (4) good management as the four fundamental principles upon which to work to build up our pastures to the very best possible in economic grassland-production.

Our thanks are due to Messrs. S. H. Saxby and L. Gorman, of the Plant Research Station staff, for assistance in connection with the trials under review. Also we are indebted to Mr. J. W. Todd for superintending field-work on the plots.

Effect of Sprayed Chlorates on Pasture.—A correspondent asks, "What is the effect on pasture after spraying ragwort with sodium or calcium chlorate ?" The experience of the Fields Division is that when the material is used at strengths of not more than 5 per cent. there is only slight burning, and the pastures rapidly recover, although the ragwort is effectively destroyed. Stronger solutions (10 to 20 per cent.) cause more burning, and pasture takes a considerable time to recover. Heavy dressings (1 cwt. to 2 cwt. of the crystals per acre) destroy most of the pasture, but reseeding takes place in a few months. Apparently any bad effects from the chlorates disappear in from four to six months. This is also the experience in other countries.

Bees and Orchard-spraying.—In his book, "Profitable Honey Plants of Australasia," Mr. Tarlton Rayment remarks: "Bee-farmers adjacent to orchards often lose heavily because of ignorant growers who persist in spraying—with poisonous compounds—trees in full bloom. Though it is very necessary to spray for the purpose of keeping fruit pests in check, scientists have demonstrated the danger of damaging the pollen at certain stages. A decreased percentage of pollenization (consequently less fruit set) frequently results from the ill-directed use of poisons. Fortunately, all progressive orchardists are well aware that the proper time to spray is just before the blossoms open and again as the petals fall."

POTATO-MANURING IN THE SOUTH ISLAND.

RECOMMENDATIONS TO GROWERS FROM EXPERIMENTS OF SEASONS 1924–25 TO 1929–30.

Fields Division, Department of Agriculture.

DURING the past six seasons over sixty experiments have been conducted by the Fields Division on the manuring of potatoes. A report dealing more fully with these trials will be published in a subsequent issue of the *Journal*. It is considered desirable, however, to present the salient features of these trials and the recommendations arising from the results for the guidance of farmers prior to the planting season of 1930–31.

Up to and including 1927–28 the work was confined to Canterbury, but in 1928–29 it was extended to Otago and Southland, and in 1929–30 to Marlborough. Two experiments were conducted in 1924–25, and over twenty in 1929–30.

Only those experiments which have formed the major part of the work are considered here. Two principal types of experiments will be dealt with—namely :—

A. Those in which different quantities of superphosphate were compared with one another and with no manure.

B. Those in which the effect of adding potash and nitrogen to superphosphate was investigated.

Type A Experiments.

The treatments were: (1) No manure; (2) super at 3 cwt. per acre; (3) super at 5 cwt. per acre; (4) super at 7 cwt. per acre.

SUPER 3 CWT. PER ACRE VERSUS NO MANURE.

It has been possible to compare the effect of using 3 cwt. of super per acre against no manure in thirty-six trials. In thirty-one of these super gave significant increases in yield of table potatoes ranging from 4 cwt. to 2½ tons per acre. A summary of the approximate average increases per acre of the table and seed potatoes, calculated on thirty-six experiments, is as follows: Table, 20 cwt.; seed, 6½ cwt.: total, 26½ cwt.

NOTE.—In all trials the yields of small potatoes, which are usually left on the ground or fed to pigs, were also measured, but are not included here.

SUPER 5 CWT. VERSUS SUPER 3 CWT. PER ACRE.

These treatments have been compared in nineteen experiments. In seven trials super 5 cwt. caused significant increases over super 3 cwt. Most of the increases occurred on land of natural high fertility and good water-retaining capacity, such as the Kaiapoi potato soils in Canterbury. The average increase per acre of super 5 cwt. over super 3 cwt. for nineteen experiments is as follows: Table potatoes, 4½ cwt.; seed, 2 cwt.: total, 6½ cwt.

SUPER 7 CWT. VERSUS SUPER 5 CWT.

Only three out of nineteen experiments revealed a significant superiority of super 7 cwt. over super 5 cwt. in yield of table potatoes. The average over the nineteen trials shows a superiority of super 7 cwt. over super 5 cwt. to the extent of 4 cwt. of table potatoes and 1 cwt. of seed per acre.

Type B Experiments.

The treatments were: (1) Super 3 cwt.; (2) super 3 cwt., plus sulphate of ammonia 1 cwt.; (3) super 3 cwt., plus sulphate of potash 1 cwt.; (4) super 3 cwt., plus sulphate of ammonia 1 cwt., plus sulphate of potash 1 cwt.

EFFECT OF ADDING NITROGEN IN THE FORM OF 1 CWT. OF SULPHATE OF AMMONIA TO SUPER.

Comparisons between super plus sulphate of ammonia and super have been made in thirty-three experiments. In eighteen of these significant increases in the yield of table potatoes due to sulphate of ammonia have ranged from 6 cwt. to 24 cwt. per acre. The average increases per acre in table and seed potatoes for the thirty-three experiments are as follows: Table, 9½ cwt., seed, 5 cwt.: total, 14½ cwt.

Climatic conditions rather than soil-fertility appear to effect the response to nitrogen. Dry conditions, especially after December, seem to inhibit the beneficial action of nitrogen.

EFFECT OF ADDING SULPHATE OF POTASH TO SUPER.

Out of thirty experiments potash has increased the yield of table potatoes significantly in nine cases. The increases have ranged from 6 cwt. to 36 cwt. The average increases per acre in table and seed potatoes for the thirty experiments are: Table, 5½ cwt.; seed, 1½ cwt.: total, 7 cwt.

Soil rather than climatic conditions appear to effect the response to potash. Potash responses have been most marked in Southland at Gore and McNab, but have occurred in Canterbury at Temuka, Willowbridge, Mitcham, Kirwee, and Leeston.

EFFECT OF USING A COMPLETE MIXTURE OF SUPER, PLUS SULPHATE OF POTASH, PLUS SULPHATE OF AMMONIA.

In general, sulphate of ammonia has given results when added to super plus potash similar to those resulting from its addition to super alone. Results from potash added to super plus sulphate of ammonia have been somewhat similar to those resulting from the use of potash with super alone. The scope of this article does not allow full discussion of a few anomalous results which have occurred.

Recommendations to Farmers.

(1) The use of super at 3 cwt. per acre is strongly recommended. On the better-class potato soils heavier quantities are worth trying, but on the lighter soils, less retentive of moisture, there is no justification for using more than 3 cwt.

(2) The indications are that, if used consistently, sulphate of ammonia at 1 cwt. per acre *as an addition to super* will pay. Since response to nitrogen appears to be governed by the season's weather conditions, and since it is not possible to forecast these conditions, it seems likely that only the consistent use of sulphate of ammonia can hope to recover in the good "nitrogen seasons" what little it may lose in the unfavourable ones.

(3) In parts of Southland potash appears to be the most important limiting manurial factor in potato-growing, and its use, especially in conjunction with superphosphate, should not be neglected. Sulphate of potash should be used. In Canterbury the trial of potash would appear to be justified in the districts indicated. The results indicate that potash is not such an important factor in Canterbury as in England and Europe, where it is used almost universally for potatoes.

(4) A limited amount of experimental evidence indicates that application of manures in the row is better than broadcasting before sowing. Where suitable machinery is not available, hand application in the row should be practised.

—*A. W. Hudson, Crop Experimentalist, Plant Research Station, Palmerston North.*

WINTERING OF STORE PIGS.

THE VALUE OF MEAT-MEAL.

K. W. Gorringe, Instructor in Swine Husbandry, Live-stock Division.

The satisfactory feeding of growing pigs in this country during the winter, when skim-milk or whey is not available, has up to the present been very difficult—so much so, indeed, that many farmers avoid autumn farrowing or make no effort to carry store pigs through the winter. The unsatisfactory position of the autumn litter in New Zealand is well shown by the average number of pigs marketed per sow. There are in the Dominion about 70,000 breeding-sows, and the total number of pigs killed per year approximates 500,000, or seven pigs per sow. Of this number less than 100,000 represent pigs that are brought through the winter, the remainder being derived from spring litters.

In order to put pig-rearing on a satisfactory basis it is essential that the number of pigs marketed per sow should be increased to at least twelve, by making the production from late summer and autumn farrowing as efficient as is spring farrowing. The only way that this can be done is to carry through the winter all autumn litters in a healthy and thriving condition, so that when dairy by-products become available they can be rapidly and profitably converted into pork or bacon.

Dairy-farmers can provide at a cheap rate an abundance of roots—particularly mangels—for the feeding of store pigs. Mangels, by themselves, can be viewed as practically useless for the wintering of young pigs, but when supplemented with a flesh-forming food they are quite satisfactory for efficient use from the weaner stage onwards. Up till quite recently an efficient and reasonably priced flesh-forming

food for winter feeding was not available to the pig-raiser, and this was the prime reason why the unsatisfactory position of the wintering of store pigs arose. Fortunately the pig-farmer has now at his command an excellent food in the shape of meat-meal, which at the price being charged—about £11 to £12 per ton—may be regarded in combination with roots such as mangels as sufficiently cheap to make the wintering of young pigs effective and profitable.

A recent experiment at Canterbury Agricultural College, conducted by Mr. M. J. Scott, demonstrated that with meat-meal fed at the rate of ½ lb per day in conjunction with mangels young pigs made satisfactory and profitable winter gains. The result of this experiment was viewed by the Department of Agriculture as so important that the Department decided to carry out a series of trials in co-operation with farmers, in order to find out exactly what live-weight increases took place when young pigs were fed through the winter simply with farm-grown roots supplemented with ½ lb. of meat-meal per pig per day, and under ordinary farm conditions.

Trials with mangels and meat-meal have been carried out on eleven farms, nearly two hundred pigs being placed under test. In these trials it has been shown that pigs from the weaner stage onwards, winter-fed with mangels supplemented with ½ lb. of meat-meal per day, put on just over ½ lb. of live-weight increase per day. In other words, 1 lb. of meat-meal produced 1 lb. live-weight increase. As meat-meal costs a little over 1d. per pound, and 1 lb. of live-weight increase can be put down as worth not less than 4d., feeding with mangels and meat-meal can be viewed as highly satisfactory, and provides an efficient method whereby profitable wintering of store pigs can be undertaken.

The general adoption of wintering store pigs on meat-meal and roots (particularly mangels, as they can be produced on small farms cheaper than any other root crop) is likely to revolutionize pig-raising in this country by enabling autumn litters to be as profitable if not more so than those spring farrowed. Every £1 spent on meat-meal for the wintering of pigs would appear to be capable of returning £4, provided adequate quantities of farm-grown roots are available and management conditions are reasonably good.

A report giving particulars of the Department's co-operative trials will be published shortly in the *Journal*.

Late Infestation of Codlin-moth.—Mr. G. H. McIndoe, Orchard Instructor, reporting on this subject, states: "The possibility of late moth infection was exemplified at Gisborne last season. Up to the latter part of February the weather was cold and wet, with every indication of an early autumn. It was reasonably expected that the February spray would give all the protection desired In the first week of March the weather became hot and dry, and towards the middle of March newly hatched grubs were very plentiful. It would appear that either the flight of the earlier broods was delayed by the cold weather, or that higher temperatures promoted a flight which normally should not have occurred until the spring. Up to the end of March, which was the driest for over fifty years, fresh hatchings were still noticeable."

THE BLUEBERRY.

ITS DEVELOPMENT IN NORTH AMERICA AND THE NEW ZEALAND INTRODUCTIONS.

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THE blueberry belongs to the genus *Vaccinium*. It is allied to the bilberry, huckleberry, and mountain cranberry. The high-bush blueberry of the eastern United States of America is *Vaccinium corymbosum*, while the low-bush species is *Vaccinium angustifolium*. The bilberry, sometimes called whortleberry, is *Vaccinium myrtilus*; it is a native of Britain and Northern Europe, where it grows on the high moorlands and peaty bogs, its fruits are gathered and are used for making jellies and tarts. The huckleberry, which is a native of North Carolina, is *Vaccinium hirsutum*. The mountain cranberry is *Vaccinium erythrocarpum*, and grows wild in the south-eastern United States. Berries which grow in Alaska, Washington, and Oregon have been identified as being *Vaccinium ovalifolium*, a tall species, bearing blue fruits; *Vaccinium parvifolium*, bearing bright-red berries; and *Vaccinium membranaceum*, which bears dark-purple berries. These berries are said to be neither true blueberries nor huckleberries, but related to the whortleberry.

In Canada the wild-blueberry crop is one of the most profitable of the berry crops grown in that country, and it has a commercial value equal to if not greater than that of the strawberry. In 1926 the blueberry crop, in addition to furnishing the needs of the people of Canada, had a surplus available for export amounting to 3,644,551 lb., worth approximately £66,600. This value was said to be about five times greater than the strawberry crop exported that season. The only labour required for profiting from the wild blueberries is that of picking, for there is no expense in planting and cultivating the crop.

During the past seventy years much investigational and hybridizing work has been done in connection with the blueberry. Eleven new commercial varieties of improved blueberries have been developed through selection and breeding. The new varieties have been evolved from the high-bush blueberry, *Vaccinium corymbosum*.

The blueberry grows wild in many parts of the United States. The hardy low-bush species flourishes in and about bogs and swamps in the States of Maine, Minnesota, New York, and Wisconsin. The plants are generally small in stature, with slender stems and fine roots. These plants increase naturally by means of underground stems or rhizomes, which push out from the more vigorous plants to a distance of from 2 ft. to 3 ft. The tips of the stems then turn upwards and grow out of the soil and develop leaves. The young plants continue to grow and develop branches and roots, and become self-supporting. Each parent plant sends out from three to four rhizomes each year. The low-bush plants in their wild state produce clusters of berries which vary in number per cluster up to fifteen, while under cultivation an average of thirty to forty berries to the cluster is usual.

The high-bush blueberry of the eastern United States in its native habitat grows to a height of from 4 ft. to 15 ft. The fruit is black in colour and of the size of a black currant. Selection and hybridization has increased the size of these fruits up to $\frac{5}{8}$ in. in diameter.

There was a time when little attention was paid to the commercial culture of the blueberry. People in the vicinity of the wild blueberry areas gathered the fruits and marketed them. As the fruit became better known and appreciated the demand for the berries increased. Prices were sufficiently encouraging as to induce a number of people to cultivate the bushes. One enterprising settler in Florida made a collection of the best wild forms growing in his district, sufficient to plant $2\frac{1}{2}$ acres of drained swamp land The plants grew much better and produced a greater quantity of berries under cultivation than they did in the wild state. The venture was quite successful, and it was the means of attracting others to cultivate the blueberry for commercial purposes.

Dr. F. V. Colville, botanist to the United States Government, became interested, as also did the nursery firm of Joseph J. White, Inc., of Whitesbog, New Jersey, in the improvement of the blueberry. Dr. Colville devoted a great deal of time and energy to blueberry-breeding experiments at Washington. As an instance of the labour involved in introducing new hybrids it may be stated that out of more than 27,000 plants set out in the trial grounds and tested only three were considered worthy of being named and of being placed on the market. By 1928 Dr. Colville had raised eleven hybrid plants which he considered of sufficient merit for propagation for commercial purposes. Mr. White has propagated and was recently growing in his nursery at Whitesbog 25 acres of selected and tested plants.

Trials which have been made with the hybrid blueberries indicate that Carbot is the best early variety, that Pioneer is the most desirable mid-season variety, and that Rubel the finest late blueberry. A second choice of varieties may be made from the following: Early season—Adams; mid-season—Sam, Rancocas, and Katherine; late season—Grover, Harding, and Dunfee.

The Pioneer variety is described as follows: "Pioneer (Colville hybrid 620A) was the first seedling from the Government trial grounds to be selected for further propagation. It grows with wiry branches to a height of 6 ft., forming a neat bush 4 ft. in diameter. The leaves are from 1 in. to 2 in. long and $\frac{3}{4}$ in. across. The flowers are of a waxy greeny-white colour, with sometimes a tinge of pink, and are produced in clusters. Each berry is light blue in colour and measures $\frac{1}{2}$ in. in diameter. When fully ripe the berries are very sweet. The seeds are so small that they are hardly noticed when the fruit is being eaten."

Blueberry plants begin to bear when three years old, but as a rule they do not produce full crops until they are from five to ten years of age. Hybrid blueberries planted out at a distance of 3 ft. by 5 ft. apart yielded at the following rate: First year after planting, nil; second year, no commercial crop; third year, 30 bushels per acre; seventh year, 96 bushels per acre; eighth year, 117 bushels per acre.

The berries range in size from the size of a black currant up to $\frac{5}{8}$ in. in diameter. The bushes producing the larger berries have been specially

developed through hybridization. To ensure a satisfactory crop it is advisable to plant together two or more varieties which flower at the same time, for cross-pollination purposes.

There is nothing unusual about the harvesting of the blueberry crop. The berries require to be handled as carefully as the fruit of other berry-plants. The fruit is picked as soon as it is fully ripe, as is indicated by the colour at the stem end of the fruit. The berries do not drop readily, and hang well on the bushes. They also keep and carry well.

Speaking of propagation of the blueberry Stanley Johnston, of the South Haven Experiment Station, Michigan, says,—

> The difficulty of propagating the blueberry has been the chief obstacle in the way of rapidly developing the cultivated-blueberry industry. Budding and grafting are out of the question, except for experimental purposes, for the reason that new shoots are continually being sent up from the crown of the plant below the graft union. If plants are already established, mound layering is the easiest method of propagation. However, only a small number of rooted shoots are obtained from each plant by this method, and it is necessary to sacrifice the crop of the parent plant The rooting of cuttings is a slow, difficult task; in fact, it is a task for an experienced propagator. Even then the percentage of rooted cuttings is low, averaging about 25 per cent. No doubt the scarcity of propagating wood of the improved varieties, together with the difficulty of propagation, accounts for the present high prices of the plants. Various experiment stations are working on the problem, and undoubtedly considerable valuable information will soon be available

The soil requirements are stated briefly by L. M. Ware, of the Alabama Board of Horticulture, as under:—

> It is established, practically beyond question, that the blueberry can be raised on varying types of soil with little cultivation, little fertilization, no spraying, no pruning, and with little care. Plantings were examined on deep sandy soil with practically no clay subsoil, both in well-drained upland and more retentive soil of lowlands, and in all cases the berries seemed to be producing abundantly Plantings were also examined under different conditions of cultivation and fertilization. On uncultivated, unfertilized plantings the berries seemed to be producing abundantly, but where cultivated and fertilized had responded well to the additional care. An ideal type of soil is a sour, sandy soil with a fair amount of peat or humus, and with a permanent supply of soil-moisture, but still well drained.

Summarizing Dr. Colville's advice, success in blueberry-culture rests particularly on—

(1) An acid soil—especially one composed of peat and sand; the possession by the roots of a fungus that appears to have a beneficial function in supplying them with nitrogen.

(2) Good drainage and good soil-aeration. Although high-bush or swamp blueberry occurs frequently in swamps or other wet places, the plants occupy situations which are exposed to the air during the root-forming period of summer and autumn.

(3) Permanent but moderate soil-moisture.

Growers may here be warned not to apply lime to the soil, because it affects the plants like poison. The blueberry plantation should receive the same good attention as is given to other berry fruits in cultivation. Blueberries respond to clean cultivation and a system of green cropping. On account of the shallow rooting of the plants the cultivation must not be deep, otherwise much serious damage will be done to the roots of the plants. In hot summers the plants should be mulched with peat, lawn trimmings, or any suitable garden refuse. Stable manure is injurious to the bushes, and should not be used.

Beneficial results have been obtained by the use of the following fertilizers in early spring: nitrate of soda, 100 lb.; rock phosphate, 260 lb.; sulphate of potash, 40 lb. per acre. This is followed by a second application of nitrate of soda at the rate of 100 lb. per acre at blossoming-time.

The low-bush varieties may be planted at a distance of 3 ft. by 6 ft. This will provide the plants with plenty of room for many years, and provide adequate room for cultivation. The high-bush blueberries require to be planted up to 20 ft. apart, according to the dimensions to which the mature bush develops.

The blueberry appears to be particularly free of disease, and, as far as can be learned, requires no spraying In Maine the blueberry maggot has been recorded as attacking the berries and causing loss. Birds are fond of the berries, and will devour them as they ripen unless steps are taken to protect the fruit. In parts where there are rabbits the bushes should be protected, as the rabbit appears to be fond of the shoots.

The blueberry as a garden plant is a welcome addition to the shrubbery, and, like most *Vacciniums*, its crimson leaves in the autumn add to the splendour of the garden. Its autumn effect in the garden was known long before any value was placed on the berries.

The New Zealand Introductions.

Whether or not blueberries will become a commercial success in New Zealand still remains to be proved. The majority of the plants which have been introduced through one reason and another have not flourished as was expected when they were planted. Unsuitable soil conditions have been principally responsible for so many of the plants doing poorly in the past. During the past year, however, a number of the plants have been transplanted to more congenial conditions, and already they have made new healthy growth.

The varieties which have been introduced into Otago and Southland during the past seven years are tabulated below.

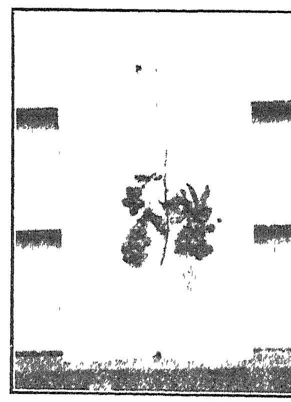
Variety.	Number of Plants introduced.		Total Plants.
	Invercargill.	Dunedin.	
Rubel	2	1	3
Sam	5	1	6
Harding	3	1	4
Adam	1	..	1
Grover	..	1	1
Pioneer	..	1	1
Dunfee	1	..	1
Names not known	5	..	5
Total	17	5	22

NOTE.—Two plants—one Dunfee and one Sam—have died.

Following are a few notes regarding the plants which have succeeded best so far (June, 1930):—

A bush of Rubel growing at Otatara, near Invercargill, is now 3 ft. 6 in. high and fruiting regularly. Sufficient fruit was obtained in

the past season to make some jam, which in colour and flavour was somewhat similar to that of Cape gooseberry. When fully ripe the fruit was of the size and had the mild flavour of the Black Champion currant. The plant blossomed at the end of October, the flowers being of similar size and shape to those of heath-bells. When the flowers opened the colour was pale pink, but later it changed to an ivory white. The fruit is ripe at the end of January or beginning of February.

RUBEL BLUEBERRY BUSH GROWN BY MRS. T. J. PALMER, OTATARA.
On right, some of the fruit.

The bush of Sam growing at Maori Hill, Dunedin, is 3 ft. 6 in. high. In the past season it carried eight sprays of fruit, with from six to twenty fruits per spray.

The Grover is 3 ft. high, and bore thirty-eight sprays of fruit in the past season, with up to ten fruits per spray. Several pies were made with the berries, which were declared to be delicious. Blueberries and cream were also tried and were much appreciated. The slight acidity, together with the flavour of the berries, made a delightful dish.

Apart from the fact that blueberries provide a very nice dessert fruit, an important point which recommends them for further testing is that they may be the means of bringing into production some of our lands which are at present of little value for anything else. Blueberries would probably grow well on the sandy-peat soils in various parts of New Zealand when the land was drained, and might be the means of additional income being derived from such areas.

STRATFORD DEMONSTRATION FARM.

NOTES ON OPERATIONS, SEASON 1929-30.

J. M. SMITH, Instructor in Agriculture, New Plymouth (Chairman of the Farm Committee).

THE policy of reducing the arable cropping area at the Stratford Demonstration Area to a minimum and paying more care and attention to pastures and their management, as laid down some few years ago, was adhered to last season. Of the 140 acres comprising the farm only 4 acres were under the plough for the purpose of growing supplementary fodder. This area comprised 3 acres of mangels and 1 acre of carrots, which, owing to unfavourable spring and early summer weather conditions, gave yields below the average.

PASTURES.

Pastures made very favourable growth during the season, and the flush was such that despite a large area shut up for hay and ensilage it was necessary to use the mower to cope with the growth Harrowing was carried out as time and opportunity occurred. There is no doubt that more harrowing should be done, but as regards this phase of pasture management we are more or less in the dark as to what constitutes the ideal amount. It is hoped that during the present season we shall be able to carry out some very definite experimental work with regard to harrowing, &c.

HAY AND ENSILAGE.

With the reduction of the area under supplementary fodder crop it was necessary to conserve a larger proportion of hay and ensilage than had yet been done. The making of ensilage plays a big part in the control of pasture growth, and in a good season for grass it naturally follows that an increased amount will be made. Fields 5, *7d*, *14a*, 15, and part of 16—a total area of 30½ acres—was harvested for ensilage, there being three stacks and one hillside pit. A special report has been prepared on the experience of the farm with the two methods—the pit and the stack. [See page 176.] Field *7c*, and part of Field 16, totalling 15 acres, were used for hay.

RYE-GRASS AND CLOVER STRAINS.

With a view to determining which strains of rye-grass are the more permanent and which strains are likely to prove the most suitable in the Stratford district, an area of 4 acres was sown on the farm in the spring of 1929 with 200 plots, representing some fifty different strains. Included in the trial are all of the principal New Zealand strains, as well as certain commercial lines from overseas. The plots were top-dressed with various manures, so that some idea will also be obtained as to the behaviour of the various ryes under different manurial treatment. It is too soon as yet to report on the results of this trial, but it is hoped to conduct a field-day on the farm this spring, when the plots are showing up well.

A further area, 1 acre in extent, was sown with fifty plots representing twenty-five different strains of clover. These include most of our New-Zealand-produced red and white clovers, and also a number of both from overseas. As with the ryes, this experiment should afford some very definite local information as to the right types of clover to include in permanent grass mixtures.

Pasture Top-dressing Trials.

The various standard trials as laid down some years ago were continued during the season. The whole of the pastures were top-dressed about fourteen months ago, chiefly with slag. This season they are to be dressed chiefly with lime and superphosphate.

The chief trial carried out during 1929–30 was one with nitrogenous fertilizers. Part of this test had been in operation during the preceding year. At the beginning of the 1928–29 season Field 7, 10 acres in extent, was divided into two equal areas One of these was termed the "nitrogen area" and the other the "phosphate area"; that is, one had nitrogen added besides the phosphatic dressings which both received. Both received identical dressings of phosphate, but the nitrogen area had nitrogen applied at varying intervals. An accurate record of all grazing was kept, as was also the milk-yield when the stock were on the different areas. While the grazing figures provide an accurate measure of the growth up to a point, the butterfat production cannot accurately be credited to the paddocks that the stock are actually grazing on when that milk is being produced, as there is a certain carry-over from paddock to paddock. The two paddocks were not merely grazed in rotation, but the cows were put into them when the grass had grown to what was considered the ideal stage for grazing. Thus it would be possible for one area to be grazed twice to the other's once, and so on. The actual top-dressing of the two areas during the first year (1928–29) was as follows: -

Nitrogen area —	3 cwt. basic slag ..	.. June, 1928
	1 cwt. sulphate of ammonia	.. July, 1928
	1 cwt. sulphate of ammonia	. October, 1928.
	1 cwt sulphate of ammonia	.. January, 1929.
	1 cwt. sulphate of ammonia	.. March, 1929.
Phosphate area—	3 cwt. basic slag, June, 1928.	

The grazing is stated in terms of "cow-days," which represents one cow for so many days, or so many cows for one day. For instance, thirty cows in for three days would be ninety cow-days; the equivalent of ninety cows for one day or one cow for ninety days. The grazing and butterfat for the 1928–29 season were as follows:--

Nitrogen area — 296·6 cow-days	.. 334 lb. butterfat per acre.
Phosphate area—301·3 cow-days	.. 334·9 lb. butterfat per acre.

As indicated, the trial was continued during the 1929-30 season, when dressings were made as follows:—

Nitrogen area —	3 cwt. basic slag ..	.. June, 1929.
	2 cwt. sulphate of ammonia	.. June, 1929.
Phosphate area —	3 cwt. basic slag ..	.. June, 1929.

The grazing and butterfat produced during the 1929–30 season, were as under:—

Nitrogen area -- 344·7 cow-days	.. 381·42 lb. butterfat per acre.
Phosphate area—294 cow-days	.. 322·25 lb. butterfat per acre.

Taking the seasons individually, at first the ammonia appears not to have paid during the 1928–29 season, but the reverse was the case during the 1929–30 season. When going further into the figures, however, one finds that the nitrogen area produced a great deal more feed during the early spring months, when feed is much more valuable than later on. On the other hand, the phosphate area produced more later on, which evened the figures up. This shows the areas, so far as grazing days are concerned, on even terms, whereas the nitrogen area should show to advantage.

During the 1929–30 season Field 12, a 10-acre area, was divided into three equal parts, and one part treated with Nitrophoska, one with superphosphate, and one with Leunaphos. Nitrophoska and Leunaphos are two concentrated fertilizers manufactured on the Continent of Europe. Nitrophoska is a complete manure containing 16·5 per cent. nitrogen, 16·5 per cent. phosphate, and 20 per cent. potash, while Leunaphos contains 20 per cent. nitrogen and 20 per cent. phosphate. The amounts of all three fertilizers applied (Nitrophoska, superphosphate, and Leunaphos) were based on the phosphate content, so that all three areas got equal amounts of phosphate during the season, while the Nitrophoska and Leunaphos areas got equal amounts of nitrogen. The superphosphate area received its phosphate at one dressing, but the other manures were applied on four occasions. The dressings per acre were as follows: Nitrophoska, 1 cwt. in September, 1 cwt. in November, 1 cwt in January, and 1 cwt in March; superphosphate, 3 cwt. 24 lb. in September; Leunaphos, 90 lb. in September, 90 lb. in November, 90 lb. in January, 90 lb. in March. Grazing was carried out on the same lines as that on the other nitrogen area The grazing and butterfat resulted as follows:—

Nitrophoska--	211·3 cow-days	28·8 dry-stock days.	229·7 lb butterfat per acre.
Superphosphate--	211·2 cow-days.	60 3 dry-stock days.	244·7 lb butterfat per acre.
Leunaphos--	189·5 cow-days.	4·6 dry-stock days.	224·2 lb. butterfat per acre.

While the results of this experiment are by no means conclusive, the indications are that the time has not yet arrived for general use of these concentrated fertilizers.

THE HERD.

Fifty-four cows were milked during the season, the average butterfat yield per cow, based on factory returns, being 321 lb. This is a decided increase on the figures of the preceding season, which were 308 lb. per cow. It is the intention of the farm committee to increase the herd during the current season by at least five head.

GENERAL.

During the year the manager, Mr. Strong, tendered his resignation, and Mr. C. Henderson was appointed in his place.

Farmers in the district are invited to make full use of the farm and visit it oftener. It is felt by the committee that a decided increase in membership of the Farm Society would do much to create active interest in the work, and with this in view a recommendation has been made to have the subscription reduced.

ENSILAGE-MAKING METHODS.

THE PIT COMPARED WITH THE STACK AT STRATFORD DEMONSTRATION FARM.

J M. SMITH, Instructor in Agriculture, New Plymouth.

WITH a view to introducing the pit method of conserving ensilage a concrete hillside pit was built at the Stratford Demonstration Farm during the season of 1929–30. In common with the position on the majority of farms in the Stratford district, where the country is slightly broken, several suitable sites were available. The main points about a site for a hillside pit are, firstly, proximity to the paddocks where the crops are to be saved and to those where feeding-out is to be done; and, secondly, the securing of a hillside with sufficient depth and with good access and exit to and from the pit-bottom. This latter point is very important, as practically the whole of the carting out is done during the winter months, when, with heavy loads of ensilage, the cutting-up of the roadway will be considerable.

A very suitable site conforming to both of these conditions was selected on the farm. The area of land that can be called on to fill the pit is about 30 acres, while the pit-bottom strikes a conglomerate material that in itself makes a very suitable road. In this instance it was possible to have one road leading in and another leading out, both with good grades. The matter of having the two roads is not so important, provided there is sufficient room at the pit-bottom to turn and that there is a good grade out The two roads are an advantage, however, as turning with a wagon at the pit-bottom means a good deal of wear-and-tear even on a well-metalled road. The advantage of having a pit built on a hillside is that it minimizes the actual handling of the green material and the finished ensilage. There is no undue lifting, as each operation means handling the stuff *down*. An opening, 4 ft. in width, the whole depth of the pit, with the exception of the top 4 ft., is left on the side of the pit looking out from the hillside, and through this opening the ensilage is taken out during the feeding-out process. During the filling of the pit the opening is boarded up as the pit is filled, the boards being rabbeted together and so made perfectly airtight.

CONSTRUCTING THE PIT SILO.

In building, the pit was first bored out to the prescribed size, which in this instance was a circle 20 ft. 8 in. in diameter to a depth of 14 ft. The walls were kept perpendicular. On the inside of the pit was built a wall or lining of concrete 4 in. thick. Only one set of boxing some 3 ft. in depth was required, which set completed a ring round the pit. No boxing is required for the back of the concrete as the solid earth wall is sufficient. Buttresses some 6 in. in thickness were built on either side of the opening to give strength to the structure, for at this point there is no earth wall to support the concrete; these buttresses are 3 ft. wide. No reinforcement was used, except for 10 ft. back on either side of the opening and for the buttresses. The pit was brought some 2 ft. 6 in. above ground-level, and a great deal of the spoil from

the excavations was used to form a ramp up to this height to allow the sweeps to work right up to the edge of the pit. The ramp was graded off to some 15 ft. back from the pit, and this rise of 2 ft. 6 in. in 15 ft. presented no difficulty for sweeping. A removable lean-to roof of wood and iron was constructed in three sections, and has a fall of 1 in 40. The sections were bolted to three plates, which in turn were bolted down to the concrete of the pit. Two men can remove the roof without great difficulty.

After due consideration it was decided to have the pit built by contract, and tenders were called for the job. The tender accepted was in the vicinity of £100, but this cost included the excavations and roof as well as the concreting. In most cases a farmer would do his own excavation work, and, provided he had the boxing, the concrete work would present no difficulty; so that a similar pit could be built at a much reduced cost.

Making the Pit Ensilage.

A start was made with the filling of the pit early in December. The procedure followed was for one man to begin mowing when the others started milking in the morning, and to cut till breakfast-time. After the routine work, such as washing up and cleaning the milking-shed had been completed a start would be made with the ensilage. One man would operate the sweep, working so that he would bring in a load from near the pit and then one from much further afield. This gave the men at the pit more time to handle the material. A second man was stationed at the top of the pit, his duties being to pull the sweep load to pieces and fork it into the pit. From the top of the pit where the sweep left the load it was possible for this man to feed the green material right to the builder, and this saved a further man in the pit. The builder, receiving the material in small forkfuls, was able to make a good job filling, and the material was evenly distributed—not in rolls as one sometimes sees it. Careful building in the pit is just as essential as it is in the stack, if first-class ensilage is to be made The centre of the pit was kept high in building, and due attention was given to the walls. Filling was commenced on 9th December, and continued on the 16th, 20th, 24th, and 27th, from 5 ft. to 6 ft. of material being put in on each occasion. When the last lot of green material was added the mass was some 6 ft. above the top of the pit, and it was nearly a fortnight before it had subsided enough for the roof to be put on.

The top of the ensilage was not weighted in any way, although it is common practice to put about a foot of soil on, as is done with ensilage stacks. The idea was to determine just how much waste would occur without any weight, and to get some idea as to whether the labour incurred in topping would be compensated for in the reduced waste that should occur. Taking everything into consideration, the result of this trial proved that leaving the stack without any weight is not a payable proposition. The waste on top averaged about 6 in. all over, which would represent about 3 tons of ensilage, while to the depth of about 2 ft. the ensilage ranged from dark to light brown, which is of slightly inferior quality to the green. Below this depth the ensilage was of splendid quality, being almost as green as the day it was saved and slightly sour.

Stack made for Comparative Purposes.

In order to get some idea of the saving effected by the pit silo as against the stack method of conserving in regard to labour, waste, &c., a stack was built in an adjacent paddock at the same time as the pit was being filled, and all details of labour, &c., were accurately kept. This stack was commenced on 14th December and completed on the 23rd, after six days' building. As against three men employed on the pit it was necessary to have four men and a boy working on the stack—one on the sweep, one at the stack-bottom, two on the stack, and a boy to lead the horse of the hoist. The size of the stack was 18 ft. by 20 ft., and was 6 ft. in height when it had finally settled down. The estimated weight of ensilage in the stack was 50 tons, as against 85 tons in the pit. The actual time worked on the stack was 150½ hours, while the filling of the pit occupied 125 hours. The boy's labour for leading the horse was reckoned as half of that of a man. Basing the labour at 2s. 6d. per hour the cost of labour for the stack was £18 16s. 3d., or 7s. 6d. per ton, as against £15 12s. 6d., or 3s. 8d. per ton, for the pit. The number of hours for the pit includes the time estimated for topping up with soil, had this work been carried out. Assuming, then, that the stack contained the same quantity of ensilage as the pit—85 tons– the total labour cost would then be £31 17s. 6d. for the stack and £15 12s. 6d. for the pit, or a saving of £16 5s. in favour of the pit. In addition to this no allowance has been made for the extra horse that was required for the purpose of working the hoist.

Advantage lies with the Pit.

The actual waste on the stack was 1 ft. deep on all the walls and about 1 in. at the top. This estimate of wall wastage is on the conservative side. The wall wastage in the pit would not exceed 2 in., and as labour for topping up has been reckoned in the case of the pit it is only fair to assume that the wastage would have been the same as that of the stack—namely, 1 in. on top. Reckoning the weight of ensilage at 45 lb. to the cubic foot, it is found that the total waste in the case of the stack is 9 tons 15 cwt., or 19·5 per cent., while in the case of the pit it is 3 tons 8 cwt., or 4 per cent. Again, assuming that the stack contained 85 tons, the waste could be reckoned as 16½ tons, as against 3 tons 8 cwt. for the pit. Putting the conservative value of £1 per ton on the ensilage, the value of the waste material in the case of the stack would be £16 10s., as against £3 8s. for the pit, or a saving of £13 2s. on the pit. Thus the total saving in favour of the pit is £16 5s. for labour and £13 2s. for wastage, a total of £29 7s. As an offset against this could be reckoned interest on the capital cost of the pit—say, £7 – and depreciation—say, £2—leaving a net saving of £20 7s.

Thus it will be seen that, given a suitable site, the construction of a pit is a very payable proposition. In addition to the actual saving of over £20 there must be reckoned the ease with which the material is handled—less human energy being required—and the fact that building in the pit presents no very great difficulties, also that once the ensilage is saved it can be kept indefinitely in the pit.

IODINE CONTENT OF SOME NEW ZEALAND PASTURES.

B. W. SIMPSON, Rowett Research Institute, Scotland (On loan to Chemistry Section, New Zealand Department of Agriculture.)

EXISTING data on the iodine content of New Zealand pastures are still very meagre. That the iodine content varies in pastures grown on different soils and in different parts of the country and throughout the year is evident from a study of the work already done (Hercus, Benson, and Carter, *Journal of Hygiene*, Vol. 24, December, 1925, and Hercus and Roberts, Vol. 26, March, 1927). With a view to accumulating further data for use in advisory work on the use of iodine in manuring and in the feeding of live-stock, the Department of Agriculture has been collecting and analysing pasture samples from various sources during the past year. Results from some of this work are here briefly recorded in the form of notes and graphs.

Graph 1 shows the seasonal variation in the iodine content of some pasture samples from Fendalton, Christchurch. It will be seen that the maximum point for this pasture is in July and the minimum in December. The maximum does not occur at the same time of the year in all areas, nor will it occur at the same period every year on the same area unless the climatic conditions are the same.

Samples from a hill pasture at Karori, Wellington, taken throughout the year, gave the results shown in Graph 2. It will be seen that the maximum is in the autumn and early winter, and the minimum in the summer.

Taking the Christchurch graph as a standard for comparison, the iodine content of the following samples may be of interest:—

At Taita, in the Hutt Valley, near Wellington, the pasture on a cow paddock in April had 70 gammas* per 100 gammas of dry weight, and in June the same. This is well over the Christchurch samples for April, but not so high as the Karori hill pasture in April. The hay paddock on the same farm in April had 86 gammas, in June 57, in July 72, and at the end of September only 30 gammas.

On Gear Island, Petone, at the mouth of the Hutt River, in June the pasture had 40 gammas, in July 45, in September 60, and in November it fell to 27 gammas.

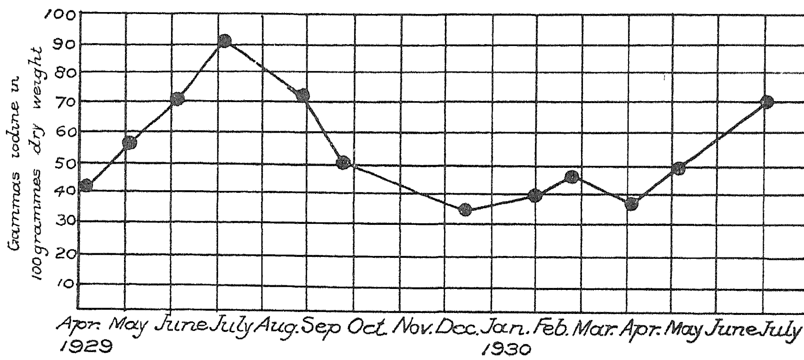
A sample from Inglewood, Taranaki, had 77 gammas, one from Wanganui 68, another from Halswell, Christchurch, 36, and a fourth from Ohau, Horowhenua, 36 gammas, all being sampled in April.

Pastures from Dargaville, North Auckland, had in May 94 gammas (this was mostly cocksfoot), in June 57, in July 133, and at the end of August 56 gammas.

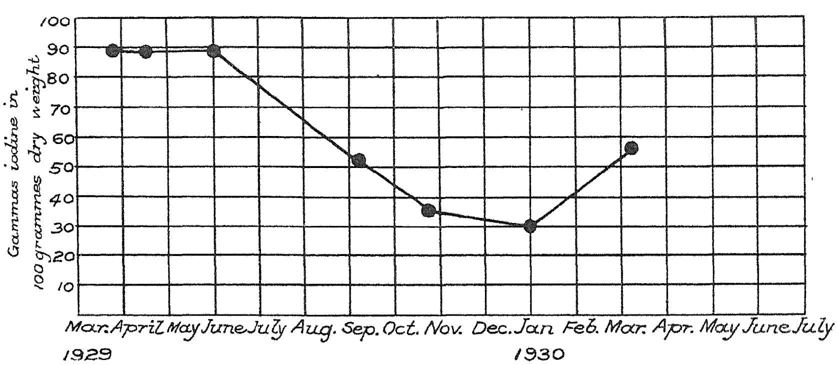
Heathcote pastures in June had 51, and in September 33 gammas, while one sample from the Cashmere Hills had in June 64, and in September 41 gammas. Both these localities are near Christchurch.

Six pasture samples from South Auckland areas, where sterility and eclampsia occur in stock, gave the following figures in September: Newstead, 28; Ruakura, 41; Koromatua, 49, 28, and 65; Taupiri, 40 gammas.

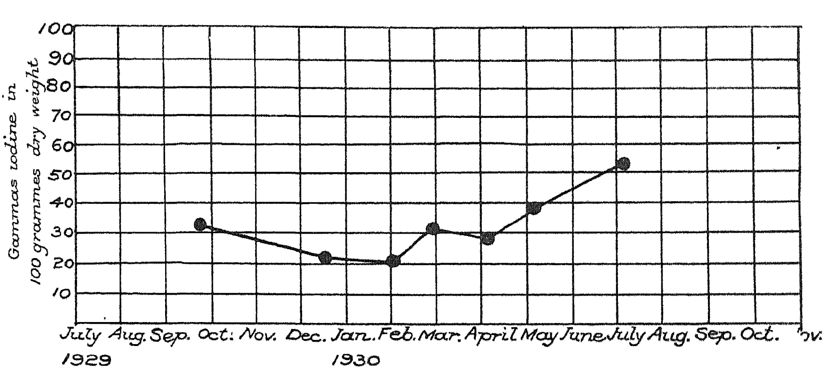
* A gamma (γ) equals one-millionth part of a gramme.



GRAPH 1 SHOWING SEASONAL VARIATION IN IODINE CONTENT OF PASTURE SAMPLES FROM FENDALTON.



GRAPH 2 IODINE CONTENT OF KARORI HILL PASTURE



GRAPH 3. IODINE CONTENT OF TAI TAPU PASTURES.

Eight pastures from Otago, sampled at the end of October and the beginning of November, gave 27, 40, 65, 43, 54, 32, 25, and 19 gammas respectively.

Wanaka and Makarora samples taken at the beginning of November gave 32, 14, 32, 11, 13, and 17 gammas, while a Lincoln sample, also taken in November, gave 96.

Pastures from Hawera, sampled in August and October, gave 55 and 47 gammas respectively.

Tai Tapu pastures sampled throughout the year were of peculiar interest because they showed such a slight variation, the minimum being at the end of January and the maximum in July. This is shown in Graph 3.

Whangarei samples were also of comparative interest These were not taken periodically from the same places, but are general samples taken at various times of the year from different places in the Whangarei area Results were as follows. Golf-links (10/6/29), 101 gammas; Maunu (13/6/29), 164; Maunu (9/7/29), 191; golf-links (15/7/29), 70; golf-links (22/8/29), 153; general pasture (21/9/29), 157; hill pasture (28/11/29), 91 gammas.

Four Gisborne pastures sampled in January gave 45, 54, 39, and 41 gammas respectively.

General.

A systematic investigation of the iodine content of New Zealand pastures might be of some help in the solution of such problems as the distribution of endemic goitre and the seasonal occurrence of certain deficiency and other diseases in cattle and sheep.

Some figures may be quoted from the literature on nutrition for comparison with New Zealand figures. In Scottish pastures amounts of iodine range from 26 to 200 gammas per 100 grammes of dry matter In English pastures the range is from 21 to 500 gammas, and in the United States of America from 0·2 to 17 gammas. Both in Scotland and in New Zealand the iodine content has been found to be highest in autumn and winter.

It should be noted that contamination of soil is sometimes difficult to avoid when sampling pastures, and, as the iodine content of soil is generally very much higher than that of pasture, the figure representing pasture iodine may not always be very accurate.

The method used for the estimation of iodine in the pasture samples here quoted was the titrimetric method of von Fellenberg, as used by Leitch and Henderson and modified in certain details. An amount of 10 grammes was ashed, extracted, and oxidized in the usual way. For titration four aliquot portions (5 c.c.) from a volume of 25 c.c. were taken; to these were added one drop of NH_2SO_4 and one drop of a saturated solution of bromine water; this volume was then boiled down to 1·15 c.c., and cooled and titrated with N/500 thiosulphate, after adding one drop of a potassium iodine solution and one drop of a starch solution. The blue colour disappears completely when excess of thiosulphate is added, but comes back on standing if too little has been added.

The Department expresses its indebtedness to those officers who sent pasture samples for analysis, and also to Messrs. Hounsell, Whangarei; Harding, Dargaville; Lysaght, Hawera; August, Taita; Lee, Gear Island; Newcombe, Karori; Wall, Ohau; Royd, Fendalton; McComb, Christchurch; Morgan, Tai Tapu; and Miss Kidson, Christchurch.

THE MANAWATU-WEST COAST FARM COMPETITION.

R. P. CONNELL, M.A., Fields Division, Department of Agriculture, Palmerston North.

As a result of the official advocacy of improved methods of farming, leaders of the farming and business communities of the Manawatu-West Coast district commenced to ask themselves the following important questions: (1) Are the potentialities disclosed by the practices of successful progressive farmers commonly known? (2) Is not emphasis at times being placed unduly upon certain phases of agriculture which promise development, while at the same time other phases which have greater promise are being somewhat neglected in popular attention?

A meeting representative of all interested sections of the community was convened a few months ago at Palmerston North by the Dairy Farmers' Union to discuss these questions At this meeting it was established—(1) that the results obtained by certain farmers indicated potentialities for greater and cheaper production in farming generally; (2) that the lessons to be gained from the results of successful progressive farmers were not being taken advantage of generally, because there existed no means of readily directing public attention to them; (3) that it is in the interest of farmers, and also of those responsible for the finance of farmers and of those trading with farmers, that the potentialities for greater and cheaper production be fully understood in order that they be better exploited. It was thought that a suitably designed farm competition would be of much value in directing public attention and study to such potentialities, and it was decided to inaugurate such a competition without delay.

The work of designing and conducting a suitable competition was allotted to an executive committee consisting of the following, who are delegates of the bodies mentioned after their names: Messrs. N. Campbell, chairman (Dairy Farmers' Union), D. Collis (Manawatu and West Coast A. and P. Association), A. Dear (New Zealand Farmers' Union), W. H. Gimblett (Manawatu Herd Testing Association), M. H. Oram (Palmerston North Chamber of Commerce), R. P. Connell (Department of Agriculture), W. J. Croucher (Manawatu branch of the New Zealand Pig-breeders' Association), T. Ranford (Manawatu-West Coast Dairy Companies' Association), and J. H. Mason (dairy breed associations).

Details of the competition formulated by the executive committee follow.

(1) *Scope.*—The competition is open to owners or occupiers of farms fulfilling the following conditions:—

(*a*) Farms situated within that part of Wellington Province bounded by the Rangitikei River on the north, the Ruahine and Tararua Ranges on the east, and the coast-line for the remaining boundary.

(*b*) Farms of 30 acres or more in area, of which at least 50 per cent. of the income is derived from dairy products, including milk, butterfat, pig and poultry products, and calves and other stock bred in connection with dairying.

(*c*) Farms on which at least 80 per cent. of the dairy stock are on the farm all the year round

(2) *Judging.*—The judging is to be done by a judging committee of four consisting of a practical farmer, a land valuer, an accountant, and a representative of the Department of Agriculture. This committee will carry out all necessary valuations and visit the competing farms several times during the currency of the competition.

For the year 1930–31 competition the judging committee consists of Messrs. D. Collis, Kairanga, farmer; Oscar Monrad, Palmerston North, land-valuer, R. H. Spencer, Palmerston North, registered accountant; and R. P. Connell, Department of Agriculture.

(3) *Scale of Points.*—For the guidance of the judging committee the following scale of points has been adopted:—

(*a*) Cost of production: Allotted 35 per cent. of total points. The cost of production of butterfat would be worked out. The monetary results of other lines—such as pigs, sheep, or poultry—would be debited or credited to the Butterfat Account as demanded by the nature of these results.

(*b*) Total production per £100 invested: Allotted 35 per cent. of total points.

(*c*) Stock: Allotted 20 per cent. of total points. In this section all types of stock would be considered, and particular attention would be given to such matters as their yields, their breeding, herd-testing, and provision made for additions.

(*d*) Farm goods and equipment: Allotted 10 per cent. of total points. Under this section would fall farm buildings, yards, water-provision—their suitability and upkeep; implements—their suitability and care; reserves of ensilage, hay, roots, &c.

(4) *Competition Prizes.*—The following schedule was adopted: 1st prize, £25, and £5 in value of suitable cup; 2nd prize, £15; 3rd prize, £5. It was further decided that there should be a minimum of ten entries or no first prize, six entries or no second prize, three entries or no competition.

(5) *Confidential Nature.*—Information required from competitors to be treated as strictly confidential.

(6) *Period.*—The competition to commence on the 1st July, 1930, and to extend over a period of one year.

General Features of the Competition.

The limiting of the competition to farms "of which at least 50 per cent. of the income is derived from dairy-products which include milk, butterfat, pig and poultry products, and calves and other stock bred in connection with dairying" makes the competition essentially a dairy-farmers' one. At the same time, however, it is left open in a very

desirable way to farmers who are exploiting in a substantial manner other lines such as sheep, pigs, and poultry This is in keeping with the aims of the promoters of the competition, who desire information about the development of side-lines which are fitted to give either more effective use of dairy by-products or more effective production and utilization of crops. For instance, it is considered that a point worth studying is whether the strong development of a side-line leading to the profitable employment of more labour facilitates the production of extra feed for dairy cows at critical periods, and thereby improves the general efficiency of the farm.

The allotting in the scale of points of 70 per cent. of the total points to matters to be considered under the headings "Cost of Production" and "Total Production per £100 invested" means that the competition awards will be decided essentially on economic considerations, since the matters falling under the headings mentioned will, when considered jointly, give a comparatively thorough indication of the financial results being obtained by a farm. In other words, the scale of points was drafted specifically for the purpose of giving weight to farm-management results as distinct from farm-method results. This was done because while farmers may ask how to grow a crop they also rightly may ask whether they should grow it at all. The second question may on occasions be a more important one than the first—that is to say, the farm-management problem may be the more important consideration. As management efficiency is reflected in the farm's economic position, prominence has thus been given in the scale of points to the directly economic considerations.

In conformity with the fact that the competition awards will be decided mainly on economic considerations, the aim has been to provide that the judging will be carried out in such a way that—

(1) Success in award will not go necessarily to the farm which is "model" in layout, upkeep, and appearance. Money spent in obtaining "model" characteristics will be a handicap rather than an advantage in the competition unless the expenditure is adequately reflected in the returns. The competition does not aim to foster overhead non-productive expenditure.

(2) Success will not go necessarily to farms operated on high-quality soil. Careful farm valuation will be made This will have a direct bearing on the cost of production and the total production per £100 invested—two items which weigh so heavily in the scale of points. It is quite conceivable that the winning farms will be well-farmed ones on relatively poor country.

(3) Success will not go necessarily to the farms with the herds of highest production—such production may be obtained at too great a cost.

(4) Success will not go necessarily to the farm showing lowest cost of production, because this may be secured by undue restriction of output, and at the expense of total possible net profit. Increasing the cost of production may increase the total profit, and this is usually more desirable than mere low cost of production. This is exemplified by considering two 50-acre farms, one of which produces 7,500 lb. of

butterfat at 12½d. cost per pound, while the other produces 10,000 lb. butterfat at 13d. cost per pound. With butterfat selling at 1s. 3d. per pound, the farm with the higher cost of production is the better financial proposition.

(5) Success will not go necessarily to the farms showing highest production per acre. This may be obtained at too great a cost. A production of 300 lb. butterfat per acre may not be as desirable as one of 250 lb., because of the excessive cost of producing the extra 50 lb. of butterfat. The competition is designed to secure data on such matters.

(6) Success will not go necessarily to the farmer who has a large family able and willing to work for him without wages, thereby eliminating the necessity for the bringing-in of outside labour. Family labour will be charged for at reasonable current rates.

(7) Success will not go necessarily to the farmer who fails to incur reasonable expenditure such as is entailed in top-dressing, herd-testing, &c., in order to keep down production costs for the period of the competition. In the judging, what the farmer does not do and should do in the interests of economic farming will be considered as much as what he does do Hence, what the farmer who skimps in necessary expenditure gains in one way he will be very likely to lose in another way. In brief, a farmer may be inclined to set himself the task of winning the competition by avoiding outlay on practices or improvements that are in the interests of permanent good farming. He should remember that his acts of omission may be found more to his disadvantage than to his advantage.

(8) Success will not go necessarily to those who attempt to take undue advantage of past efforts. For instance, a man may carry over into the competition period large reserves of hay, ensilage, roots, &c. If these are used during the competition period, then their equivalent in similar reserves or in cash allowances must be provided at the completion of the competition.

The executive committee sought the funds for conducting the competition from farming and business organizations which are directly interested in the growth and spread of knowledge of improved farming, and gratifying financial support has been obtained from these sources.

Competitors were charged an entry fee of 5s. each, and twenty-five entries were received for this year's competition, which is now under way. Many of those who have entered are known to be unusually successful farmers, and thus the comparative study of their methods and results, for which the competition calls, promises to be productive of interesting information.

It is the opinion of the executive committee that the public attention which should be attracted by the competition will be materially increased as a result of the fact that Lord Bledisloe has graciously accepted the position of Patron of the competition. This patronage, which is in keeping with His Excellency's close interest in rural affairs, will thereby add to the general value of the competition.

MANAGEMENT OF CALVES ON THE DAIRY FARM.

D. MARSHALL, M.R.C.V.S., Veterinarian, Live-stock Division, Hamilton.

A GOOD start in life is of great importance to animals which will later form the dairy herds, and it is pleasing to observe that many dairy-farmers now pay much attention to the feeding and care of their calves. In many cases, however, improved practice and more knowledge are still necessary. It is with the object of providing some seasonal hints on the subject that the following notes are contributed.

ACCOMMODATION.

On some farms conditions are naturally favourable, in others artificial provision must be made. Newly-born calves in the winter and spring must be housed, and probably the best thing is a shed open to the north and admitting sufficient air and sun, with a dry earth floor which can be bedded down. The bedding should be removed and renewed sufficiently often to preserve cleanliness. If calves are tied up for a time after feeding the tendency to suck each other is lessened. Later on they may run at grass, and if a shed as described is available they will take advantage of it at night and in wet weather.

The calf-paddock should be dry and well drained, with good quality pasture, and sheltered by a close-bottomed hedge from prevailing winds. In the spring shelter helps to save feed which would otherwise go to maintaining body-heat. Too often one sees calves turned into some cold wet gully simply because it is unfit for anything else. Where hedges are absent some kind of artificial windbreak should be provided. When the pasture becomes too long it should be eaten down by the dairy herd as required. A calf-paddock should not be in use as such for more than two seasons without a twelvemonths' break. Apart from bacterial contamination, it eventually becomes infected with the larval forms of parasitic worms, which take months to die out. Thorough harrowing and liming may reduce these pests to a slight extent.

FEEDING.

The young calf should be fed three times a day, though this is seldom done except with valuable stock. The beastings or colostral milk should be given to the new-born, as it has a laxative effect and contains certain protective substances. Many now leave the calf with the mother for the first two days, which is not only best for the calf, but gives less trouble than might be anticipated. As to the amount, the tendency is to overfeed, which should be guarded against. Probably 5 lb. to 6 lb. of milk daily, increasing to a gallon (10 lb.) within the first fortnight is sufficient for Jersey calves. Very convenient calf-bails are now in general use. Feeding-places may with advantage be concreted. Strict cleanliness by scalding of all food utensils is important.

The milk should be fed as near blood-heat as possible. Benefit results from diluting the allowance of milk with 10 per cent. of lime-water and occasionally adding a pinch of salt. It is now recognized

that certain types of acute indigestion may be due to feeding a milk high in solids not fat, and the lime-water serves to reduce this high concentration and render the curd more digestible. The longer the calf can get whole, non-separated milk the better ; but as a rule, after three to four weeks this is reduced and replaced by skim-milk to an increasing extent. Usually at this stage the calf is already picking a little grass.

Calves are sometimes raised satisfactorily on whey after the first four to six weeks, provided good grazing and an allowance of concentrates is made. Meat-meal is a valuable supplement to whey, a suitable ration being about ¼ lb daily for calves three to four weeks old. Calves will early take to concentrates, and if a little dry bran and pollard, linseed-meal, or crushed oats is put out just after the milk, it lessens their tendency to suck each other. They will start taking this at three to four weeks old. Where good pastures are available, concentrates may not be necessary.

WEANING-TIME.

Weaning-time is frequently a critical stage. Where the young calf during most of its life has had suitable grazing and has been utilizing this it does not feel the loss of the milk to any extent. Unfortunately, weaning-time frequently coincides with a reduction in the milk-supply due to a drying-up of pasture, and here is where the advantage of some previous education in feeding on concentrates may be felt, as these may be continued a little longer and tide the calf over a period of shortage of grass. The provision of fresh young pasture at a proper stage is relatively as important to calves as to cows in the height of production. During the autumn and winter months good-quality hay should always be available, and may be supplemented with roots, ensilage, or whatever else is on hand. The provision of rock salt or a lick containing bone-meal, salt, iron, and iodine, is being increasingly followed and is undoubtedly valuable.

The age at which weaning takes place often varies. One progressive Waikato farmer finds that with July calves three and a half to four months is a very suitable time This seems a somewhat early age, but he finds that by weaning at this period of the year, calves are able to go on to the grass while it is still young, growing, and palatable, and that they get well established before the dry period sets in. With late calves, of course, this advantage could not be secured. If young grass or turnips and grass are available, such will be an excellent wintering place for calves, for the reason, as will be discussed later, that it is clean ground free from parasitic infection, and parasites are believed to be the cause of much of the unthriftiness seen in young stock about nine to twelve months old.

DISEASES OF CALVES.

With the exception of blackleg, probably 90 per cent. of the troubles affecting calves and causing either death or serious loss of condition may be put down to one of two causes—defects in feeding, and parasitism. The comparative importance of these causes varies inversely during the first year, digestive troubles being most important during the first three or four months, and later on parasites. It must

not be overlooked that the animal which has been imperfectly nourished is also more likely to fall a prey to invading parasites.

Scours or Diarrhœa.—An infectious disease of this type exists and may attack calves within the first forty-eight hours after birth, but it is doubtful if this exists in New Zealand, and the trouble is usually met with in calves between two and three weeks and up to two months old. The animal purges freely, the dung being liquid and whitish or greenish, depending on the amount of grass being eaten. The calf rapidly loses condition, becomes weak and sunken-eyed, and is indifferent about feeding. In severe cases blood may appear in the droppings. The cause is primarily indigestion, which may by set up by dirty feed-tins, milk too rich, in too great quantity, or given cold; or, in older calves, by too much soft green grass.

For treatment of this trouble all milk should be stopped for twenty-four hours, allowing only boiled water with teaspoonful of salt. If necessary a small dose may be given—say, four tablespoonfuls of raw linseed-oil with a teaspoonful of turpentine and two of baking-soda. Usually this is all that is required, and the calf may be gradually brought back to milk well diluted with lime-water. In more severe cases a teaspoonful of chlorodyne may be given in water, and frequent dessertspoonful doses of a powder containing equal parts of baking-soda and bismuth carbonate. With older calves, where grass is too long, it should be eaten down by older stock or the calves moved to barer pastures. The calves should be nursed according to the weather, and not hustled about unduly in their weak state.

Acute Indigestion or Staggers.—Occasionally a big thriving calf may suddenly develop an attack of rushing about, bellowing, possibly falling down in a fit, and may die suddenly. Post-mortem examination usually reveals nothing beyond a mass of very tough curd in the stomach. Treatment by a small dose of Epsom salts and baking-soda may be tried, but frequently fails. However, this trouble should be avoided by diluting the milk as previously recommended.

Parasitic Gastritis.—This is due to the presence of small worms in the fourth stomach. The worm-eggs discharged on the ground in the droppings of affected calves hatch out, and the minute forms remain in the pasture, capable of infecting other calves for months, hence the necessity for occasional changes of calf-paddock. Dampness favours them and longish pasture grass gives more cover, hence the disease is more noticeable after a wet summer. The symptoms may appear shortly after weaning, or at any time during autumn or winter. Affected calves are unthrifty, lose condition, frequently scour, and become weak, sunken-eyed, and pale in the lining membranes of the mouth, nose, and eyelids. Usually a number are affected at once. In older calves the unthriftiness alone may be evident. The carcass of a calf dead from the disease is emaciated, pale, and bloodless. Owing to the minute size of the worm most commonly responsible, examination of the lining of the wall of the fourth stomach may not always reveal the cause until a scraping from the lining is examined under the hand-lens or microscope.

For treatment the calves should at once be dosed with some reliable worm medicine such as 3 oz. to 4 oz. of a 1-per-cent. solution of bluestone given after fasting twelve hours. It may be necessary to repeat

this twice at ten-day intervals Two days after drenching the calves should be moved to fresh grazing, preferably short, and everything done to support condition, such as provision of good hay, small quantities of some concentrate, and either rock salt or a compound lick provided. Recovery is a little slow. Commercial Parrish's Food is a useful tonic for valuable calves.

Prevention consists in the provision of clean grazing-grounds for calves each year On badly affected farms probably routine drenching once every three weeks, commencing before weaning, would enable calves to go through without showing symptoms. Keeping no calves at all for twelve months might allow infection to die out, but it must be remembered that yearlings may harbour the worm without showing symptoms; moreover lambs are also the hosts of one or two of the worms found in calves, and the grazing of affected lambs on dairy-farms may be a means of introducing parasites.

Lung-worm, or Hoose.—In this trouble the parasite is in the wind-pipe and smaller bronchial tubes of the lungs. The chief symptom is a persistent harsh cough affecting a number of calves, and best noticed when they are first stirred up. Otherwise, much that was said under the heading of parasitic gastritis applies to this trouble. Treatment by drenching is of little value, and injections of turpentine, chloroform, and other substances directly into the windpipe is the only reliable method of attacking the parasite. Good feeding may enable the animal to throw it off.

Redwater.—This has been seen in calves from three weeks to as many months. The first symptom, the passage of dark-red urine, may be over-looked, and the calf soon becomes weak, refuses food, and dies in forty-eight hours or less. On post-mortem examination the carcase is pale and bloodless, and the liver dark, becoming orange on exposure. Any urine in the bladder is dark red. Usually a number of calves are affected. The cause is apparently dietetic. For prevention the best results seem to be from well diluting the milk with lime-water and adding a little salt—say, a teaspoonful per calf daily. In treatment a teaspoonful of common salt plus 10 grains of sulphate of iron, in ½ pint of milk, together with a dessertspoonful of turpentine, is recommended.

Blackleg.—This is due to a germ present in the soil in certain localities. The disease usually attacks the most thriving animals at from three months up to two years, rarely older, and most cases are in calves about six months old. The affected animal may be simply found dead, or it may be noticed sick and lame with swelling of the shoulder or quarter. The swelling has a tense feel, and gives a drum-like sound, due to contained gas. Treatment is hopeless, and animals dead of the disease should be deeply buried without opening, to prevent the spread of the infection. Inoculation of susceptible animals gives an immunity lasting over the most dangerous period, and this work has been carried out by the Department of Agriculture free of cost for many years in certain affected districts.

Actinomycosis.—This is a disease sometimes seen in calves which have been wintering on swampy country, and rarely it occurs in younger animals. The usual symptom as regards the latter is the appearance of one or more swellings the size of an orange in the throat region.

Later on the abscess ruptures and pus discharges. This condition is in most cases curable by the use of potassium iodide. As actinomycosis is one of the scheduled diseases any suspicious case should be notified to the nearest Inspector of Stock.

Tuberculosis may be present in calves, but it is very rarely that symptoms are recognizable.

Necrotic Infection of Throat.—A condition suggestive of acute sore throat, with a loud roaring sound during inspiration and much distress in breathing, is occasionally met in quite young calves. Cases investigated have been found due to infection in the throat by a common dirt germ, the bacillus of necrosis, which, incidentally, also causes foul-in-the-foot. Treatment has so far not proved successful, and affected calves are probably best destroyed at once, as they suffer great distress. Preventive measures should be directed towards greater cleanliness of yards and feeding utensils, though it must be admitted that this throat trouble has also been seen where hygiene was of a high order.

Conclusion

In conclusion one may summarize: Keep the young calf warm; feed the young calf well, but not too well; feed the older calf better; provide clean grazing-ground; dose with a reliable worm remedy once a month where parasites are feared.

TESTING OF PUREBRED DAIRY COWS.

NEW C.O.R. CLASS-LEADERS.

Dairy Division.

It must be regarded as a remarkable achievement in the annals of New Zealand certificate-of-record testing that two cows commencing test in the same class in the same year, with a difference of only nine days in age and thirty-five days in calving, should supersede a class-record already held with a particularly high yield of butterfat. The two cows referred to are the Jerseys Cousin Grace and Ivondale Silver Rainbow.

COUSIN GRACE.

When Cousin Grace calved on 20th July, 1930, some 400 days after her date of calving for commencement of test, she completed her requirements for C.O.R. and at the same time qualified for the leadership of the three-year-old Jersey class. The previous holder was Mr. P. J. Petersen's Ivondale Golden Lass, with 905 lb. butterfat. Cousin Grace's final figures for the 365 days period were 14,057·6 lb. milk containing 935·21 lb. butterfat, the average test being 6·25 per cent. With the exception of seventeen days, she was milked three times a day throughout her testing period, and commenced test at the age of 3 years 318 days.

Cousin Grace is shown in the New Zealand Jersey Herd Book as having been bred by Mr. J. Shaw, of Paterangi. Her record, however, was made in the ownership of Mr. J. Bones, Kaipaki, Ohaupo, who is to be congratulated on the handling of this fine dairy animal. Cousin

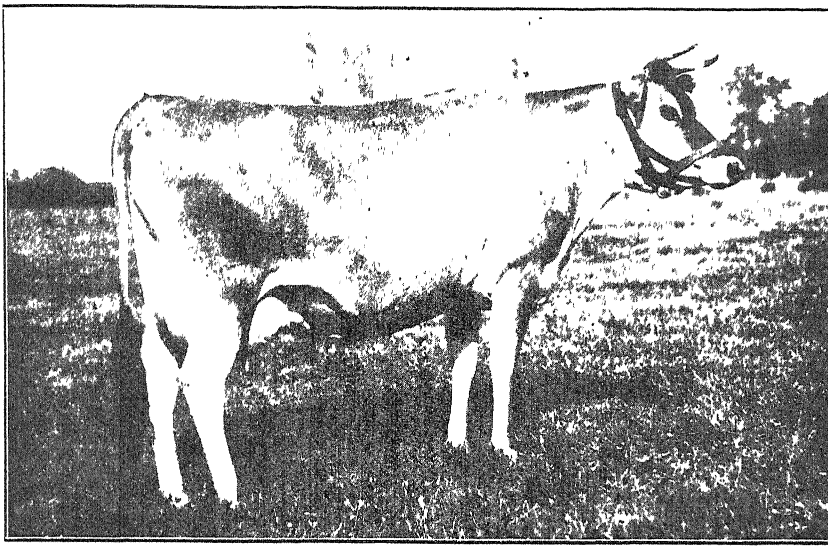


FIG. 1. COUSIN GRACE (J. BONES, KAIPAKI, OHAUPO).
C.O.R. in Jersey three-year-old class: 14,957·6 lb. milk, 935·21 lb butterfat.
[*Dairyfarmer photo.*

Grace is by Distinction's Defender from Shalotte's Grace. The bull Roberts is prominent in the pedigree, and other names well known to our C.O.R. breeders are Maiden's Gay Lord (by the imported bull Maiden's Glory Lad), Silverlock's Duke, Twylish's Maid of all Work, and Brighton Twylish.

IVONDALE SILVER RAINBOW.

Cousin Grace held the leadership just six weeks. The honour then reverted to the previous holder, Mr. P. J. Petersen, when, on 30th August, 1930, Ivondale Silver Rainbow calved subsequent to test, after having placed to her credit a yield of 15,073·4 lb. milk containing 950·63 lb. butterfat, in 365 days, the average test being 6·30 per cent. This performance is all the more meritorious when it is considered she was milked only twice daily throughout the whole lactation period. She was 3 years 327 days old at date of calving for commencement of test.

Ivondale Silver Rainbow was both bred and tested by Mr. P. J. Petersen, of Brixton, Waitara, and a review of her extended pedigree would make very interesting reading were there space to deal with it fully. Running back some six or seven generations, the attention is immediately drawn to the variety of prominent individuals—variety, because, while almost every name is that of a maker of New Zealand Jersey history, there is little similarity or apparent system in the mating. The sire of Ivondale Silver Rainbow is Xenia's Oxford Lad (imp.), member of a prominent Jersey Island family. The dam is Ivondale Rainbow's Lass, who is also the dam of Ivondale Oxford

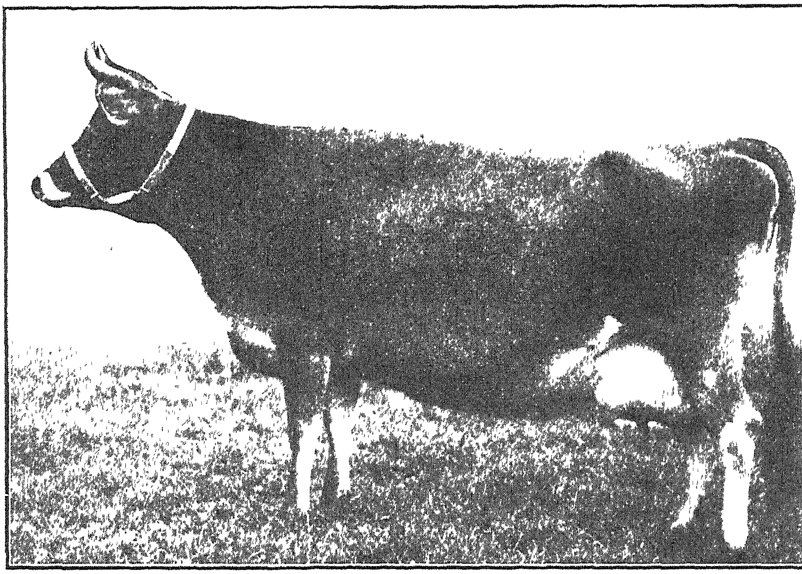


FIG. 2. IVONDALE SILVER RAINBOW (P. J. PETERSEN, WAITARA).
C.O R. in Jersey three-year-old class: 15,073·4 lb. milk, 650·63 lb. butterfat.
[*Dairyfarmer photo.*

Lass, present leader of the Jersey Junior two-year-old class Running back on the dam's side, one finds Pride of Egmont, K.C.B., Doctor, Blizzard, Optician, Larkspur, Heather, and a number of others who laid the foundation of so many of our present-day champions.

Briefly summed up, it would appear that Ivondale Silver Rainbow is a fortunate combination of many of our best blood lines, and bearing in addition whatever influence may be due to a member (her sire) of one of Jersey Island's good families. Mr. Petersen's breeding still claims three of the five Jersey C.O.R. class-leaderships, which in itself is sufficient evidence of the outstanding merit of the Ivondale stud.

MAESGWYN VICTORIA.

The third new class-leader is also a three-year-old, but of the Ayrshire breed Her name is Maesgwyn Victoria, and she was bred and tested by Mr. C. Morgan Williams, of Kaiapoi. She commenced test on 17th July, 1929, at the age of 3 years 250 days, and in 365 days produced 16,507·7 lb. milk containing 646·98 lb. butterfat, a record some 7 lb. higher than that of Mr. W. Moore's Fair Lass of Greenbank, the previous holder of the class-leadership.

The sire of Maesgwyn Victoria is Maesgwyn Victor, who on the male side traces back to Craigellachie, the sire of Alexandra of Waipapa, who at one time held the leadership of both the four-year-old and the mature Ayrshire classes. The dam of Maesgwyn Victoria is

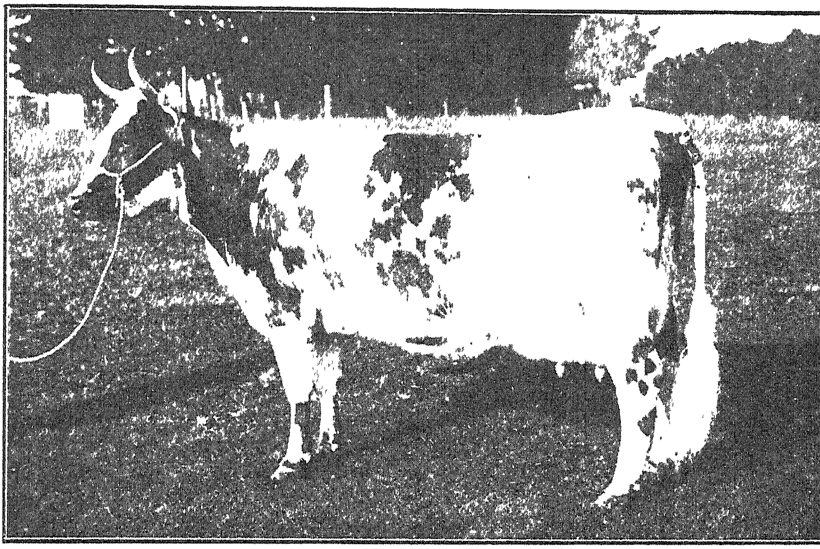


FIG. 3. MAESGWYN VICTORIA (C. MORGAN WILLIAMS, KAIAPOI).
C.O.R in Ayrshire three-year-old class: 16,507·7 lb. milk, 646·98 lb butterfat.

Maesgwyn Clover (C.O.R., 386·17 lb. butterfat), and some three generations back one finds Auchenbrain Exchange (imp.), Dominion East Newton Beauty (an outstanding matron), and Dominion Netherton Good Bonus, who had a markedly beneficial influence on New Zealand Ayrshires. Dominion Newton Gipsy also appears. Auchenbrain Exchange (imp.) is a member of the celebrated Auchenbrain stud, which produced Auchenbrain Brown Kate 4th, at one time the world's champion Ayrshire cow. It may also be mentioned that Maesgwyn Hazel, who is Maesgwyn Victoria's granddam, gained a certificate on the highest milk-yield yet credited to a New Zealand C.O.R. Ayrshire—namely, 20,723·4 lb., with a butterfat-yield of 605·44 lb.

It is a pleasure to record this further success of the Ayrshire breed, and we should like to congratulate Mr. Morgan Williams upon the breeding and handling of Maesgwyn Victoria. From the illustration which appears in connection with these notes it will be seen that she is a splendid sample of the breed, showing true dairy type and strong evidence of sound constitution.

Utilization of Imported Fruit-case Timber.—Writing on this matter, Mr. R. G. Hamilton, Orchard Instructor for the Waikato district, remarks: "I notice that the roll-cut timber of the imported cases has been condemned because of its excessive pliability. Where the ordinary-cut timber is used on the bottoms, and the roll-cut timber on the top, the bulge is usually all at the top with none at the bottom. If, however, the roll-cut timber is used as bottoms and the ordinary-cut timber for tops a very fine package is secured, with an even bulge both top and bottom. A grower in the Auckland district happened to use all the roll-cut timber as bottoms, and the improvement was very noticeable. It makes a far more even package than where ordinary-cut tops and bottoms are used."

EXPERIMENTS ON TRANSMISSION OF DRY-ROT (*PHOMA LINGAM*) OF SWEDES BY INSECTS.

W. COTTIER, M.Sc., Entomology Section, Plant Research Station, Palmerston North

THE present article is an account of preliminary experimental work carried out at the Plant Research Station, Palmerston North, with two insects characteristically found in dry-rot lesions, for the purpose of testing their capabilities in carrying the disease from infected to healthy swede bulbs. These two insects belong to the orders Coleoptera, family *Staphylinidæ* (Fig. 1*a*), and Diptera, family *Drosophilidæ* (Fig. 1*b*) respectively, and are in the hands of the Imperial Bureau of Entomology, London, for identification.

Neill (1929), in discussing the spread of dry-rot, stated that "a study of the spread week by week, and the obvious attraction to insects of spore-producing lesions, suggest very strongly that insect carriers are the main source of fresh infection." The primary infection comes through the seed.

Should one pull a dry-rotted bulb from the field there will usually be seen numerous small black insects running from the lesion (in which they breed) to the bottom of the swede and dropping off to the ground. These are the Staphylinid beetles referred to above, and as many as forty individuals may be taken from a single lesion. The persistent occurrence of these beetles in the diseased bulbs suggested that they may play a large part in the dissemination of the spores, more especially since they appear to fly only now and again, and their wandering from the diseased plant to others immediately in its vicinity could quite well account for the characteristic spread of the disease in circles from the centres of primary infection. Particulars concerning the life history of the dry-rot organism may be obtained from publications by Cunningham (1927) and of the spread of the disease in the field from Neill (1929).

The attraction of light for these beetles is very slight, and they prefer to hide in lesions rather than show themselves in the open; so that once having found safe harbourage in a rotted bulb their movement round this point would tend to be somewhat confined. That the beetles can find enough food on an apparently healthy swede has been demonstrated by the writer, who has kept them active and healthy under such conditions for two months. This shows, further, the probability of their wandering and feeding on healthy bulbs round the diseased one, using the dry-rotted swede for a base as it were. The fly used in these experiments was chosen because it breeds very abundantly and quickly in the rotted tissue of the swede.

No work was done on the method of carriage of the spore by the insect, the aim of these experiments being simply to discover whether the spores would be carried by this means.

EXPERIMENTAL PROCEDURE.

The swedes used were taken from a plot on the Station area. Dry-rot subsequently appeared in this crop in only one small patch, and this was approximately 25 yards from the spot where the bulbs

were selected Fifteen bulbs were taken on 1st March, 1930, and each was kept for a considerable time under insect-proof conditions to allow any dry-rot that might be present to develop. Three weeks later between 60 and 70 more bulbs were taken from the same spot and again kept under insect-proof conditions to allow any disease to show itself. No dry-rot appeared in any of the bulbs prior to inoculation by contaminated insects.

The Staphylinid beetles were taken from lesions in the field and kept confined on moist rotting potato tubers for three weeks prior to use (excepts in Experiments 1 *a*, *b*, *c*, and *d*). The flies also were taken from lesions in the field and bred for a generation on rotting potatoes (except in Experiments 6 *a*, *b*, *c*, and *d*).

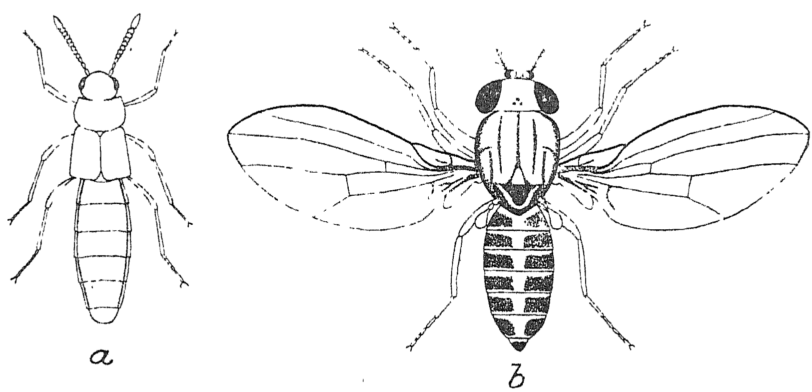


FIG 1. THE TWO INSECTS EXPERIMENTED WITH AS DRY-ROT CARRIERS

(*a*) Staphylinid beetle, (*b*) Drosophilid fly. Both enlarged about 12 times

[*Original.*

At first, on account of their slight attraction to light, it was rather difficult to obtain a satisfactory means of transferring the beetles from diseased to healthy material. The method finally evolved was as follows: Strong cardboard collecting boxes, approximately 2 in in diameter, fitted with glass tops, were used in two sets of six each. Every precaution was taken in disinfecting and in handling these boxes so as to prevent contamination by spores other than those carried by the beetles. For the most part six insects were used in each experiment. These were removed from the diseased material to a clean bench and a collecting-box placed over each. The insect in a short time had crawled up the inside of the box which could then be lifted and closed by the lid The other set of six boxes was kept on another bench, which, after six transfers, was thoroughly washed down with acidulated corrosive sublimate (1–500) and allowed to dry. The boxes (one during each transfer*) containing the beetles from the diseased material were then placed in the centre of this clean bench, with

* It must be clearly understood that there was only one box in the centre of the bench during the transfer of each beetle to a clean box.

the lid removed but still containing the insect. In all cases the two sets of boxes were manipulated by different hands. The box was then lifted and the insect allowed to run approximately 1 ft. from the spot, when it was covered by a clean box from the second set. This box was then closed and the beetle placed on a clean bulb. The operator's hands were at all times kept completely disinfected

After each lot of six transfers each set of boxes was thoroughly cleaned with acidulated corrosive sublimate and allowed to dry. It was thought, however, after the first few experiments, that spores on the insect coming in contact with the dry corrosive sublimate would possibly be killed on being subsequently moistened. For this reason all later disinfections of boxes were carried out by heat. The same possibility of killing the spores existed in allowing the beetles to run on the dry bench after it had been washed down with corrosive sublimate. To obviate this difficulty two sheets of clean paper were used in each lot of six transfers; the beetles were collected from the diseased material on one sheet, the bench then being disinfected and the insects transferred to the other boxes on a second clean sheet. The bench was again disinfected ready for another lot of transfers.

As a rule transfer of the flies was an easy matter on account of their strong attraction to light, the insects being allowed to fly from the receptacle containing the diseased material to that containing the healthy bulb.

The apparatus used for confining each bulb under insect-proof conditions is shown in Fig. 2A. The swede (*a*) was confined in a Miller No 3 lamp-chimney (*b*) resting in a receptacle (*c*) containing water. The apparatus was closed at the top by a fine muslin cover held in position by a strong rubber band. Inside the lamp-chimney the space between the bulb and the glass was packed tightly with cotton-wool to prevent the insects from reaching the water.

Several sources of infection were used—namely, (1) dry-rot bulbs from the field, (2) bulbs artificially inoculated with dry-rot strains IIA and IIB, (3) Petri dish cultures of strains IIA and IIB. The insect was allowed to feed on the well-infected bulbs, either in the apparatus shown in Fig. 2A or in a glass jar closed by a fine muslin cover.

To facilitate the handling of the flies on the culture plates a simple apparatus as shown in Fig. 2B was used. The culture plate (*a*) was inverted over one end of a glass cylinder (*b*) approximately 2 in. in diameter and 6 in. long, the end of the cylinder being pressed into the media on the plate. The other end of the glass cylinder was closed by a cotton-wool plug.

The apparatus was placed on a bench in the position shown in the figure, with the light coming directly from above In this way the flies for the most part kept on the culture at the top. For transference the cotton-wool plug was removed, the apparatus inverted, and the insects carefully allowed to fly to a sound bulb. The beetles were easily confined on the culture in a Petri dish, the whole being kept in semi-darkness, and the insects transferred by the collecting-box method.

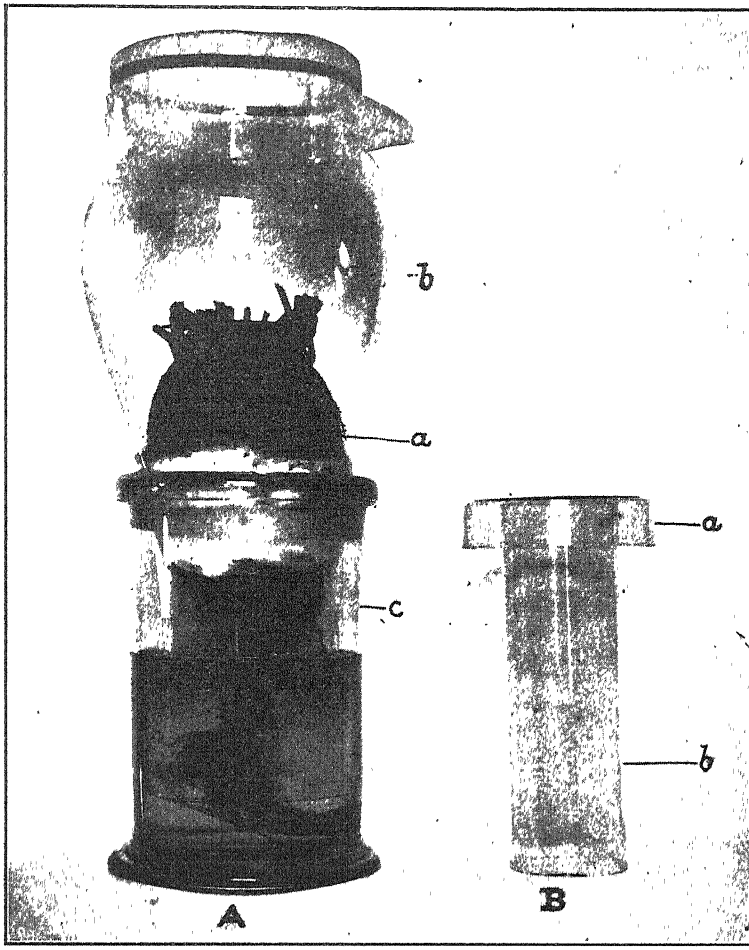


FIG. 2. APPARATUS USED (A) FOR CONFINING BULBS UNDER INSECT-PROOF CONDITIONS, (B) FOR HANDLING FLIES ON CULTURE PLANTS.

For details, see text [Photo by H. Drake.

RESULTS.

Table 1 shows the results of the experiments with the Staphylinid beetle and the Drosophilid flies respectively. The controls for all these experiments are not shown in the tables, but they consisted of twenty bulbs taken at random from those collected in a block of between seventy and eighty mentioned in the section "Experimental Procedure." Each of the bulbs was kept separately under the same conditions as those upon which insects were placed, and none developed dry-rot. These twenty bulbs may be treated as controls for each of the ten sets

of experiments shown in the tables. The air temperatures in the glasshouse were 50° to 60° F. at night and 60° to 65° F. during the daytime.

Table 1.—Results of Experiments on Transmission of Dry-rot of Swedes.

Experiment No.	Source of Infection.	Number of Insects used.	Time on Source of Infection.	Number of Bulbs which developed Dry-rot.	Number of Bulbs which remained healthy.	Time taken for Disease to show.*	Time on healthy Bulb.
			Staphylinid Beetles.				
Bulb 1a	Dry-rot lesion in field	6	..	..	1	..	1 day.
1b		6	..	..	1	..	2 days.
1c		6	..	..	1	..	5 days.
1d		6	..	1	..	28 days	7 days.
Bulb 2a	Plate containing culture of IIB dry-rot strain	6	1 hour	1	..	45 days	Not removed.
2b		6	4 hours	1	..	27 days	
2c		5	8 hours	..	1	..	
2d		6	5 days	..	1	..	
Bulb 3a	Plate containing culture of IIA dry-rot strain	6	1 hour	..	1	..	Not removed.
3b		6	4 hours	..	1	..	
3c		5	8 hours	..	1	..	
3d		6	5 days	..	1	..	
Bulb 4a	Bulb artificially inoculated with dry-rot strain IIB	6	1 hour	..	1	..	Not removed.
4b		5	4 hours	..	1	..	
4c		6	20 hours	..	1	..	
4d		6	5 days	1	..	30 days	
Bulb 5a	Bulb artificially inoculated with dry-rot strain IIA	5	1 hour	..	1	..	Not removed.
5b		6	4 hours	..	1	..	
5c		6	20 hours	..	1	..	
5d		6	5 days	..	1	..	
			Drosophilid Flies.				
Bulb 6a	Dry-rot lesion in field	6	Bred on source	..	1	..	1 day.
6b		6	,,	..	1	..	4 days.
6c		6	,,	..	1	..	5 days.
6d		6	,,	..	1	..	7 days.
Bulb 7a	Plate containing culture of IIB dry-rot strain	5	1 hour	..	1	..	Not removed.
7b		8	4 hours	..	1	..	
7c		6	8 hours	..	1	..	
7d		6	30 hours	..	1	..	
Bulb 8a	Plate containing culture of IIA strain	6	1 hour	..	1	..	Not removed.
8b		4	4 hours	..	1	..	
8c		6	8 hours	..	1	..	
8d		6	2 days	..	1	..	
Bulb 9a	Bulb artificially inoculated with dry-rot strain IIB	6	1 hour	..	1	..	Not removed.
9b		6	4 hours	1	..	12 days	
9c		5	24 hours	..	1	..	
9d		6	Bred in bulb	..	1	..	
Bulb 10a	Bulb artificially inoculated with dry-rot strain IIA	6	1 hour	1	..	30 days	Not removed.
10b		6	4 hours	..	1	..	
10c		7	Bred in bulb	1	..	27 days	

* From time of placing insects on healthy bulb.

COMMENTS.

From an inspection of the table it will be seen that the percentage of bulbs that developed dry-rot is small, but taking into consideration

the fact that not one of the controls showed a sign of the disease and the care with which the work was performed, it is considered that evidence has been brought forward to incriminate both the beetle and the fly. The conditions under which the work was carried out were very artificial, and, furthermore, the time which necessarily elapsed between taking the beetles from the infected material and placing them on clean bulbs offered considerable opportunity for the separation of mechanically carried spores from the body of the insect. A larger series of experiments is in progress under conditions as natural as possible. These are designed to show further whether or not insects play a large part in the dissemination of dry-rot spores in the field.

The writer's thanks are due to Dr. G. H. Cunningham and Mr. J. C. Neill, Mycologist and Field Mycologist respectively, of this Station, for advice and help in planning and carrying out these experiments; also to Mr R Brien, Culture Specialist, who provided the plate cultures and inoculated bulbs and tested any dry-rot that developed.

REFERENCES

NEILL, J C. (1929). Dry-rot of Swedes *N.Z. Journal of Agriculture*, Vol 39, pp. 86–93

CUNNINGHAM, G. H. (1927). Dry-rot of Swedes and Turnips Bull 133, N Z. Dept of Agriculture

NEW DAIRY REGULATIONS.

A NUMBER of amendments and additions to the Dairy-produce General Regulations were gazetted on 7th August, 1930, and came into force on that date. The most important of these may be briefly summarized as follows :—

(1) The registration of a dairy company may be cancelled if, in the opinion of the Director of the Dairy Division, the quality of any dairy-produce manufactured or otherwise produced at such manufacturing dairy is intentionally made inferior to the quality that could be attained, having regard to all relevant circumstances.

(2) It is made illegal for milking-machine agents to install milking-machines in a manner not in conformity with the present regulations.

(3) It will be illegal, after 1st July, 1931, to sell for use in connection with milking-machines rubberware which is not branded with the manufacturer's name or brand.

(4) Milk and cream must be protected from the entry of birds, rodents, and other animals.

(5) In the North Island the three grades for cream are to apply all the year round.

(6) In the grading of full-cream factory cheese or standardized milk cheese, as from the 1st August, 1930, the following will be the maximum points for allotment: For flavour, 45; body, 20; closeness, 20; colour, 10; finish, 5.

(7) Butter for export must contain not less than 1·5 or more than 2 per cent. salt, except by arrangement with the Director of the Dairy Division to fill special orders.

Correction.—In the title "Varieties of Apples and Pears passed for Export, Season 1929," on page 144 of last month's *Journal*, the date should read "1930," as indicated by the context.

SEASONAL NOTES.

THE FARM.

Pasture Management.

THE pasture-management position is, at times, subject to rapid and radical changes between early spring and late spring. During that period there may be a change from the extreme of really hard and injurious grazing to the extreme of insufficiently close grazing. It is practically certain that the latter extreme occasions much the greater amount of pasture-injury and avoidable loss From October onwards for several weeks on many farms the grazing is of a type which allows of a proportion of the vegetation reaching the flowering stage Flower-head development is definitely undesirable. This is because it not only marks a falling-off in the digestibility of the nutriment in the herbage, but also means that the different nutriment substances are not present in such well-balanced proportions as characterize shorter and more leafy growth. Pasture-growth which is dominantly leafy is excellently suited to meet the requirements of wet stock, whereas pastures at the flowering stage are far from ideal sources of forage for such stock. Hence, in October it becomes necessary to prevent pastures becoming too long and mature in development.

The main means that may be employed to this end are (1) effective grazing management, (2) reserving for hay and ensilage all growth not needed to meet the current requirements of the stock, (3) distribution of droppings before they have been deposited long enough to bring about patches of rank, unrelished growth; (4) "topping" of pastures as an emergency measure when more than sufficient grassland has been kept under grazing, or when an area is characterized by much uneven growth due to earlier neglect in regard to harrowing

Effective grazing management results most satisfactorily from a system of alternate heavy grazing and spelling of the fields. In working such a system it is necessary to concentrate the stock on to a few fields while the others are spelled. Essential features of the system may be stated as follows:—

(1) Even and relatively close grazing of a field under grazing before stock are transferred from it. If the farm stock consist principally of cows in milk, it will be necessary to transfer them from a paddock only when to keep them there any longer would bring about avoidable and undesirable falling-off in production If a fairly substantial number of dry stock are on hand they well may follow the cows to remove inferior growth that is not readily consumed by the cows.

(2) Stock should be returned to a paddock which has been eaten down and spelled, not when all other paddocks available for grazing have been eaten down in turn, but when the growth on the spelled paddock is at the stage best suited for grazing. For instance, on a farm on which ten paddocks are being grazed, one paddock may be ready for grazing again when only six of the other nine paddocks have been grazed under this method. In such a case the three ungrazed paddocks should be dropped from the grazing programme and a return made by the stock to the paddock which has so recovered from previous grazing as to be at the best stage for grazing again. It is of vital importance to drop promptly from the grazing programme in this manner any fields which in the spring and early summer are providing feed in excess of the current requirements of the

stock. Some farmers carefully shift their stock from paddock to paddock at regular intervals. They profess to be practising systematic or rotational grazing, but actually they may be doing nothing of the sort; they do not always well graze down the growth on a paddock before taking the stock off it; they do not always return the stock to the paddock when the growth on it is at the best stage for use. As a result, they fail to obtain the benefits which effective grazing management gives.

Ensilage.

Farmers at times hesitate to drop a field out of the grazing programme because they have already planned the closing of sufficient other grassland to meet requirements in the way of hay. When this is the case the paddocks not required for grazing may very advantageously be set aside for silage production. Although the amount of silage produced has increased enormously during recent years, there are hundreds of farmers who have not as yet made silage and who could do so with distinct advantage. At this time of the year it is well to remember that ensilage has a place in our farming not only as a source of reserve feed for use when fresh grass is in scant supply, but also as a valuable means towards proper control of pasture-growth. In late spring and early summer poor control of pasture-growth almost invariably arises from making available to stock feed in excess of their requirements at that season. Good control of growth at that period is of such value as to justify closing a field from grazing, even though the way in which the surplus growth on it would eventually be used cannot be clearly seen. Really it would be better to have such surplus growth wasted, if this led to the proper control of the growth on the remaining paddocks, rather than to have growth on all paddocks poorly controlled as a result of attempting to retain an unnecessary paddock under grazing.

At times it is of great value to top with the mower growth which tends to run to flower heads, even though the mown material is not gathered. Topping of pastures in this way is particularly likely to be of service in fields which have not been harrowed enough. Regular and thorough distribution of droppings by means of harrowing makes it much easier to maintain an even leafy growth over grassland during spring and early summer.

Under many conditions silage can very advantageously be made in October or November. Particularly in districts in which ensilage is a comparatively recent development a common error is the making of silage later than is desirable. The objection to late making of silage arises partly from the fact that increase of maturity means increase of fibre. Fibre in a feed does not favour milk production, and the amount of fibre in ensilage is largely determined by the amount of fibre in the green material from which it is made. Further, when ensilage is saved later than is necessary there is less certainty of a good aftermath on the field from which it was obtained. Again, when silage production is commenced in good time the summer labour requirements in respect to supplementary feed-provision are better distributed.

Fields to be closed for hay or ensilage production should be thoroughly harrowed immediately after the final grazing of the season.

Farmers who propose to utilize new pits or trenches for the saving of ensilage should proceed with their preparation without delay if this has not already been done. In many instances when pits cannot be obtained satisfactorily on account of the contour of the farms relatively shallow trenches will serve excellently. Detailed information on this matter will be supplied on application to officers of the Department of Agriculture.

The Potato Crop.

In many districts the main crop of potatoes should be sown in October. Potatoes fare best on a loose friable soil of high fertility, and if soil of this type is not available everything practicable should be done to produce it by using artificial fertilizers freely, and by growing the crop if possible on land recently ploughed out of old pasture, so that the supply of organic matter which begets friability may be at its maximum, or by applying to the potato-ground any available farmyard manure, provided it is not unduly infested with weed seeds. A fertilizer consisting of three to four parts of superphosphate and one part sulphate of ammonia, or two parts blood-and-bone, will give good results with potatoes over wide areas. In the manuring of potatoes there are more errors due to using too little than to using too much manure.

Great care should be taken to obtain seed which is free from disease infection. The most serious type of disease, which is known as virus, cannot be detected by tuber examination. The run-out condition of much seed offering is due to virus disease, of which there is no effective direct control. The Department of Agriculture undertakes the certification of seed potatoes. The main objective of this certification is to make available seed which is true to name, relatively free from disease, and of proved cropping-power. Each line of seed that is certified has been under official trial. In regard to varieties Mr. J. W. Hadfield, Agronomist, points out that difficulty arises because of the fact that of lines within a variety there are greater differences in yield under similar conditions than occur between one variety and another. This position is due principally to the ravages of virus disease masking differences in yield between varieties.

The following are well-proved varieties: Dakota, a standard main-crop variety that generally does particularly well on medium land in Canterbury; Aucklander Short-top (usually grown in the North Island as Sutton's Supreme), a second early which is a general favourite because it is relatively reliable; King Edward, a potato of outstanding quality, but one which does not yield satisfactorily except in Southland; Arran Chief, a main-crop variety which generally is badly mixed with Northern Star and running out on account of virus, but good lines of which should at present be the mainstay of heavier land; Northern Star, definitely blight-resistant, but not worth attention outside Auckland districts; Epicure, the only early variety which can be recommended, and this only in the case of certified seed.

Relatively soon the potato-variety position will be improved as the result of current official work. For instance, at Ashburton Experimental Farm 20 acres of pure lines, practically virus-free, of all standard varieties from England, Canada, and New Zealand are being sown this year, and seed will be on sale next April.

Other Cropping Work.

Chou moellier calls for high fertility—it demands a soil of the type which would suit cabbage. If it is desired to grow chou moellier on inferior soils their fertility should be improved, farm-yard manure being a fine dressing for this purpose. If sown in October or November on fertile soils chou moellier is well adapted to provide feed in late summer. A suitable sowing is 1½ lb. to 2 lb. of seed to the acre broadcast, or ½ lb. to ¾ lb. in drills 2 ft. to 3 ft. apart. The plant responds well to liberal use of fertilizers, such as a mixture of super and blood-and-bone in equal parts; 3 to 4 cwt. of this mixture may usually be applied with profit, and such a dressing may often advantageously be supplemented with 1 cwt. of sulphate of ammonia. Chou moellier is less subject to attacks of disease than other members of the cabbage family. It is distinctly suitable for cows, pigs, and poultry. Quite a number of successful sheep-farmers favour it for carrying sheep through the winter. It will not fatten lambs as well as rape.

Preparation of land intended for roots, rape, and kale should be pushed ahead at every opportunity. It is well to remember that often inadequate preparatory cultivation results in depressed yields of forage crops In the earlier districts sowing of turnips may be commenced in October. When it is desired to have soft turnips ready for feeding as early as possible, a sowing of the quick-maturing Lincoln Red and Red Paragon varieties may be made for a start. Other varieties of proven merit are Hardy and Imperial Green Globe and Purple-top Mammoth. Soft turnips may be sown through every second coulter of the grain drill at the rate of 8 oz. of seed to the acre, or on ridges 24 in. to 26 in. apart at the rate of 1 lb.

An October sowing of Western Wolths or Italian rye-grass will often give useful feed about Christmas or immediately afterwards.

Lucerne.

If lucerne areas have not as yet been shut up this should be done immediately Many stands suffer serious damage because the first cut for ensilage or hay is taken off too late in the season The more the lucerne area is invaded by weeds the greater is the need to remove the first cut of the season as early as is practicable, for the longer the weeds remain uncut the more prolonged is their injurious effect on the lucerne plants, with which they compete for light and nutriment.

True and False Economy regarding Equipment.

Reference may fittingly be made at this season to the confusion between false and true economy that at times occurs in respect to the equipping of farms with implements and other plant It is not necessarily true economy to continue using equipment merely because it is far from worn out and therefore appears to have definite value. When it is a matter of considering whether a piece of equipment should be scrapped the true test is not whether it is capable of rendering further service, but whether it can or cannot be replaced by some other equipment which would so effect the efficiency of the farm as to enable the money involved to earn a higher rate of interest.

To give an instance, many farmers are doubtful about the advisability of purchasing modern grass-harvesting equipment, because the carts, &c., which have served for years have still many years of life in them. This latter fact does not at all justify the retention of such equipment in use. Indeed, it is quite conceivable that its retention, instead of being true economy, would be the cause of loss of potentially valuable returns which would result from the improved grassland management coming from such a practice as ensilage-saving that improved equipment would make possible. Similar lines of reasoning may soundly be applied to many other types of farm equipment, such as harrows, drainage implements, and possibly tractors.

It is important to remember that success in farming depends in many matters on getting the work done at the right time. Certain equipment may enable a job to be done well, but not at the right time or not without neglecting some other job. Such equipment is not to be compared in value with that which allows of all work being done at the right time. The aim in this note is not to go into a detailed consideration of the position, because each farm presents its own problems, but to point to the importance of differentiating in practice between true and false economy in regard to equipment.

Seasonable Care of Implements.

All implements and equipment that will be in use during the saving of hay and ensilage should be made ready for immediate use, well

ahead of the time when they are likely to be put to use. Time lost through faulty equipment, especially in connection with the saving of hay, at times proves very expensive. A point of seasonable importance is the fact that the foundation of successful mowing is a sharp knife. Time and again mowing troubles due to clogging and stopping will disappear as a result of using a thoroughly sharp knife. The knife forms with the bed of the finger-bar a pair of long scissors, and to work efficiently it must be sharp, straight, and, above all, well down on the bed. In addition to the knife being really sharp it is necessary that the fingers be in line and their points kept straight, sharp, and smooth. Bent or blunt finger-points will stop the mower just as effectually as dead grass

—*R. P. Connell, M.A., Fields Division, Palmerston North*

THE ORCHARD.

Spraying Operations.

What may be termed the active season in the orchard commences with the month of September. Bud-shields will be shed, while foliage and blossom will become exposed to the attacks of insect pests and infection with fungus diseases. In consequence, spray controls will become imperative, commencing on stone-fruits at bud-movement, and on pome-fruits at green-tip.

The standard formulas recommended at different stages are as follows —

Stone-fruits.

For control of bladder-plum, brown-rot, die-back, leaf-curl, leaf-rust, peach scab, and shot-hole fungus—

Bud-movement Bordeaux 5–4–50, or lime-sulphur 1–15.

Early Pink In those districts in which brown-rot is prevalent additional applications of a lime-sulphur solution, consisting of either lime-sulphur 1–120 or self-boiled lime-sulphur 8–8–50, or precipitated sulphur 8–100, are essential.

Later periods: The lime-sulphur or sulphur sprays should be repeated one month after petal-fall, again three weeks later, and again shortly before the different varieties ripen. Self-boiled lime-sulphur is specially recommended; an application of this spray an hour before picking stone fruit will be beneficial in preventing brown-rot developing after the fruit is placed on the market.

Pome-fruits.

For control of black-spot, pear scab, fabraea scald, apple-spot, and blister disease—

Green-tip: Bordeaux 5–4–50, or lime-sulphur 1–10.

For varieties of pears most susceptible to pear scab, bordeaux 6–5–50 can be recommended, followed by bordeaux 4–4–50 at pink and 3–4–50 at the calyx stage. A word of warning may be given here with regard to the application of bordeaux at what is regarded as the green-tip stage. It would appear that last season some of the excessive russet experienced in certain districts was due to bordeaux 6–5–40 and 6–5–50 being applied at a stage when the trees had advanced beyond what is correctly regarded as green-tip.

Open Cluster to Pink: Lime-sulphur 1–30 to 1–50, according to variety; or bordeaux 3–4–50, according to variety.

For varieties of apples which are supersensitive to burning of foliage or russeting of the skin, less risk is entailed by confining the spraying

to lime-sulphur. If necessary the lime-sulphur content may be supplemented by adding precipitated sulphur in quantities ranging from 5 lb. to 10 lb. per 100 gallons.

Petal-fall: Lime-sulphur 1–100 to 1–120, to be repeated ten days later, or as frequently as climatic conditions or the prevalence of disease makes application necessary. This spray should be continued until the period for harvesting the different varieties arrives.

Apples required for storage should receive an additional application of lime-sulphur 1–100 shortly before picking. In this connection growers who can find opportunity to apply an oil spray of 1–150 immediately prior to picking those varieties subject to scald in cool storage may do valuable work for themselves.

Insect Pests

For codlin moth, pear-slug, leaf-roller caterpillar, &c., arsenate of lead, 3 lb. of paste or 1½ lb. of powder to 100 gallons water, should be applied at calyx stage, and at not more than three-weekly intervals thereafter.

For control of red mite and San Jose scale at the young stage, red-oil emulsion at 1–150 should be applied immediately the young insects are noticed. Lime-sulphur 1–120, plus Black Leaf 40 at 1–800 may be used as an alternative.

A limited control of woolly aphis and bronze beetle may be expected if Black Leaf 40 is added to the red-oil emulsion. Where the activity of *Aphelinus mali* is delayed orchardists would be well advised to apply this spray to control woolly aphis.

It should be borne in mind that clean cultivation is one of the chief factors controlling bronze beetle.

Supplementary Manuring.

In addition to the main application of manure which will have been made, a special application of stimulating fertilizers such as nitrate of soda or sulphate of ammonia is good practice where trees are debilitated or stunted. A top-dressing of 1 lb. per tree of either of these manures will do much to stimulate good growth, improve the size of the fruit, and otherwise bring weak specimens into line with the more vigorous trees in the orchard.

Grafting.

The period for carrying out this work will be about the middle of the month in most districts. Care of scions, close-fitting of all unions, and careful sealing up of all cut surfaces are the essentials to success. This work was the subject of an illustrated article in the *Journal* for September, 1929.

—*M. Davey, Orchard Instructor, Mapua.*

Citrus-culture.

Planting should have been done before now. However, where this has been delayed no time should be lost in completing the work. If this is unduly delayed it may be detrimental to the young trees should the weather be dry. One is often confronted with the fact that sufficient care has not been exercised beforehand in the preparation of the soil. If this has not been done it would be much more satisfactory to defer the planting for another season.

It is possible that a good deal of damage has been done by the recent frosts. Where this has occurred it will be necessary to cut back all affected wood to a point at least below where no injury has taken place. This should not be done, however, until the danger of frost is past. In all pruning the aim should be to produce short sturdy shoots capable of bringing to maturity all fruit produced on them.

If the soil is in a suitable condition the land may be turned over with the plough, but this should not be done if the soil is in a wet or sodden

condition All care should be exercised in ploughing operations in order to minimize damage to either roots or branches; all damage so caused is detrimental to the trees.

Manuring at this period of the year should not be lost sight of Any neglect in this direction is very soon reflected in the appearance of the trees. Citrus-trees are gross feeders, and require to be carefully watched so as to find out what they require. Three manures phosphates, nitrogen, and potash—are essential to almost every tree, and should be applied in an intelligent manner. If trees are making strong healthy wood-growth, nitrogen could be reduced or eliminated, while phosphates or potash may be still necessary. The amount required can only be determined by the person growing the trees, and varies in different localities. In practically every district all trees would greatly benefit by the application of fertilizers at least twice during the year, instead of once as is commonly practised. Citrus-trees respond in a wonderful way to almost any form of mulching, but this operation is practically impossible

Growers should be making some preparation for the spraying of citrus for the control of verrucosis and scale insects, which make their appearance soon after the main blossoming is finished This will be dealt with next month, but it is well for growers to realize that the danger period is approaching, and to be in readiness to carry out the work when the time arrives. The control of all diseases is really only a matter of facing the work from a business point of view. Much of the failure is due to half-hearted methods and lack of foresight. Therefore it is wise to be well prepared to carry out each phase of the work at the correct time

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Rearing of Ducks.

THERE is still time to hatch out ducklings for the renewal of the laying flock, but an endeavour should be made to have the required number not later than the early part of November. In anticipation of early hatching the breeding-stock should be mated at once. Ducks, particularly the heavier breeds, usually have to be mated much longer than fowls to ensure the production of a maximum number of fertile eggs.

In mating Indian Runners one drake is usually allowed to six females, and for the heavier breeds one drake to four ducks. This refers to birds which are confined in runs, for on free range the number of ducks to one drake may be considerably increased. When the drakes commence fighting it is an indication that more ducks are required in the breeding-pen, or that the number of drakes should be lessened.

Ducks are easy to hatch and rear by artificial means. The temperature during the period of incubation at the level of the tops of the eggs on the tray should be 102° F. for the first week, from then on to the pipping stage 103°, and 104° when hatching. Given this degree of heat, and provided the eggs are fairly fresh when set, the ducklings will commence to pip on the twenty-sixth day, and hatch out on the twenty-eighth. Many people become alarmed at the hatch being delayed for this length of time after the pipping stage, and attempt to assist the ducklings out of the shell. This is a great mistake, for by opening the machine and interfering with the eggs in any way before allowing them their full time of hatching one is only inviting trouble.

Apart from the application of moisture, duck eggs require much the same treatment during the various stages of the incubation as do hen eggs.

The best system of applying moisture, which is one of the chief secrets in hatching duck eggs, is to spray water at a temperature of 103° with a fine florist's spray, or, better still, with the mouth, on the eggs every morning after the fourteenth day. Do this after turning, and immediately place the eggs back in the machine. It is a mistake to cool after spraying; spray in the morning and cool at night. The ventilation vents should be partly open at all times, so that any excess of moisture not required by the eggs can get away.

Ducklings require no food for at least twenty-four hours after they are hatched. For the first few days feed equal parts of bran and pollard mixed with a small quantity of oatmeal, with 5 per cent. of sharp fine grit added; moisten with hot water and mix to a crumbly consistency. Feed four times a day as much as the birds will pick up clean. Finely cut green food, such as young tender grass, lettuce, silver-beet, &c., should be fed daily after the first week. As the birds develop the oatmeal may be dispensed with, while ground wheat, barley, or oats with the husks screened out, and also maize-meal, may be included in the mash. After the ducklings are a week old the grit should not be mixed with the food, but should be kept within reach so that they can help themselves. At this stage finely broken sea-shell should also be available to them at all times to pick at. When a week old a little boiled minced meat will be much relished by the young birds, and water should be given with the first meal, and from then onwards it should always be left within reach both day and night.

It is of the greatest importance that the birds should not be given water after a long fast until they have received a meal, and even then it is a wise course to provide water with the chill taken off; further, it is well not to let them drink to excess at the outset. When ducklings are given a cold drink before food, especially if they have been confined in a brooder without water, they are almost sure to suffer from staggers, with fatal results. Ducklings thus affected give every indication of having taken a fit, falling on their backs, with eyes twitching and presenting a generally distressed appearance.

Care should be taken to arrange the brooder so that the young birds are provided with the desired uniform degree of warmth and an ample supply of fresh air, two great essentials when artificially rearing ducklings.

Although ducks are water-fowl, it is imperative that the sleeping-quarters of domestic ducks, whether old or young, be maintained in the driest possible condition, or leg-weakness is almost sure to result. During the early brooder stage the drinking-vessels should be arranged so that the ducklings can merely get their heads into the water when drinking. This will to a great extent prevent the bedding-material from getting wet. After a period of from three to four days the water-vessels should be placed in the brooder run well away from the sleeping-quarters, so as to save as much as possible the latter from getting into a wet state. At this stage the water-vessels should be of sufficient depth to allow the birds to clean out their nostrils, and so prevent them from getting clogged up, which is a common cause of the eyes becoming plastered, and failure of the ducklings to thrive. Some fine gravel placed in the drinking-vessels will generally assist in moving any food or dirt from the nostrils.

On account of the thinness of their skulls ducklings are very subject to sunstroke followed by giddiness, and therefore shade should be available to them when let out of doors. Care should be taken to see that they are well protected from their natural enemies, such as rats, stoats, and ferrets, which will attack them until they are fully three-parts grown.

On no account should ducklings be overcrowded by hatching out more than the quarters can properly accommodate. Work only with numbers that can be handled with absolute confidence. An even degree of warmth, good ventilation, and strict attention to cleanliness are among the chief factors in rearing brooder ducklings.

Provision of Green Food.

As the season advances and warm weather may be expected there should be no stint of green food on the poultry-plant. The growing birds particularly demand an adequate supply of green material. Evidence of this is frequently to be seen during hot weather when chickens practically refuse to eat grain material unless forced to by hunger, whereas if green stuff is thrown to them they will simply rush it. Obviously what they require is what they eat up greedily, and what they need for promoting healthy development—an essential requirement for future heavy egg-production. For growing stock, also, the green stuff provided should not be old and fibrous, otherwise crop and gizzard impaction are apt to result, which usually causes death.

A thing to be remembered in feeding an ample supply of green material to birds of all ages is that it not only keeps the birds in a healthy thriving state, but in addition it goes a long way towards saving the present high-priced grain materials.

Experimental Work at Wallaceville.

Although considerable knowledge is available regarding the many phases connected with the management of poultry, troubles are frequently met with under varied local conditions on which even the most practical poultrymen are unable to give definite advice as to their cause and the best means of prevention. Among these troubles may be mentioned fully developed chicks dying in the shell in incubators at the pipping stage, non-absorption of the yolk in artificially produced chicks, cannibal habits, bowel trouble, green leg, passing blood in droppings, and various conditions met with in the work of artificial brooding. There is also much to be learnt yet in regard to the control of external and internal parasitic infestation, particularly the latter, and many other problems met with in connection with the feeding, housing, and general management of poultry stock.

Experimental work to discover if possible the causes and necessary preventive measures in connection with some of these problems is being conducted at the Wallaceville Poultry Station. Investigational work is also being carried out in feeding iodine to fowls, chiefly for the purpose of ascertaining its effect on egg-production and the hatching-quality of eggs. These experiments are being carried out in co-operation with the officer in charge of the Veterinary Laboratory.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Seasonal Preparations.

OCTOBER is perhaps the period when the apiarist can do most in helping his bees to work up to full strength in time for the main honey-flow. In the warmer parts of the country swarms may be looked for about the middle of the month, but in the southern districts they will probably not appear until three or four weeks later. By the 1st October, unless the weather for some weeks has been cold and wet, every hive should have been examined, and its condition noted with regard to stores, population, and health.

No colony should be allowed to dwindle because it has not sufficient food to provide for the offspring of a prolific queen. Yet, on the other hand, some beekeepers prefer that all the old honey in the hive should be used up before the new season's flow commences. The food-supply of the

hive is sometimes an exceedingly puzzling matter, as it varies considerably in accordance with the weather and the strength of the colony, and only periodical and systematic examinations can settle the question as to whether all is well with the hives in this respect

No harm can be done by feeding good white sugar syrup, but a hive which is starved in the spring will probably not recover its strength till the main honey-flow is nearly over. By the middle of October, under normal weather conditions, every hive should have at least four frames of sealed brood, and many will have more. Those that have fewer, unless their food-supply is very short, should be marked for requeening as soon as possible The apiarist's endeavour should be to keep his colonies as even as possible, thereby obtaining a uniform surplus throughout the apiary

Wherever there is a fair yield of nectar from spring flowers the bee-keeper would do well to take advantage of the warm days of the month to treat any cases of foul-brood which he may have noted earlier in the spring. However, no hard-and-fast rule can be laid down in this matter, everything depending on locality and weather conditions. In some districts it would be almost disastrous for the beekeeper to treat his bees in October, in others, where right conditions prevail, it might be carried out with ease and safety, and the bees brought into good condition by the time a surplus may be expected. Wherever treatment has been undertaken the colonies should be watched in order to see that there is no danger of starvation, and where the spring flow is not considered heavy enough it should be supplemented by liberal feeding.

Hiving Swarms.

In most text-books on beekeeping this kind of advice is given: "When a swarm settles into a cluster take a light box and shake the bees into it," &c. This advice is all right where the bees are accommodating enough to settle into a convenient position for the shaking process to be carried out. Unfortunately, in many cases bees get into positions whence it is impossible to dislodge them so easily. Sometimes they will settle on a small bush, and much of the cluster will be on the ground. In this case probably the best thing to do is to place the box over the cluster, and if the bees do not show much disposition to climb into the box they may be persuaded to do so by the use of a little smoke. When they cluster in the centre of a prickly hedge the box should be placed on one side of the hedge, and the beekeeper should puff smoke from the other side of the hedge, and thereby drive the bees towards the box. In the event of the swarm taking possession of a fencing-post and clustering on it from top to bottom, as they occasionally do, the smoker must again be used, and in addition it is as well to brush the bees from each side of the post in turn into the swarm-box with the brush which is used for the frames at extracting-time.

The usual practice is to leave the box sheltered from the sun and covered with a sack near the place where the swarm has settled. Where few hives are kept this may be done with impunity, but if other swarms are expected it is well to remove the box to the place where the colony is to stand permanently, otherwise before the close of the day the probabilities are vary largely in favour of the box being taken possession of by three or four other swarms—a matter of annoyance to the man who wishes to keep his swarms separate.

In every case a swarm should be attended to as soon as it settles. Many people are under the impression that swarms should be left undisturbed till nightfall, but this idea is an erroneous one. They should invariably be placed in the box as soon as possible after the cluster is formed, and put so that they are sheltered from the rays of the sun

Water Supply.

One of the most important of the minor details of apiculture is the provision of a constant water supply for the purpose of assisting the bees in brood-rearing. Not only is it necessary to conserve the energy of the bees by having the water close at hand, but it is well to ensure that they do not prove a nuisance at taps, cattle-troughs, &c. From early spring till late autumn water is an absolute necessity to bees, and they will consume comparatively immense quantities in fine weather. It thus behoves the beekeeper to see that a liberal supply is always available. By establishing his drinking fountain early in the season he will teach the bees where to go for supplies, and ensure their always seeking the same spot for water. —*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Small Fruits.

In the next few weeks most plantations of small fruits will be approaching the harvest period, and little attention generally will be required apart from hoeing in bright weather to destroy weeds. Superfluous suckers in the raspberry crops should be suppressed, or, if it is a desirable variety and more plants are required, they may be lifted and planted out in nursery rows to be grown on.

Strawberries will require bedding down with straw, rushes, or pine-needles. It is very rare that this attention can be dispensed with; it forms a cooling mulch, keeps the berries free from grit splashed by the rain, and prevents the growth of weeds, so long as it contains no viable weed-seeds itself. For this reason when baled straw is used it is exposed to the open air for some time before using, so that all seeds may be sprouted and destroyed before applying it. Where new plants from runners are desired the mulch should not be applied nor the plants allowed to fruit. They then concentrate on runner production, and good early plants may be obtained. This production should be controlled, the plants will be all the better if only the first on a runner is allowed to develop.

Indoor and Outside Tomato Crops.

Warmer weather sets in during October, and the foliage of the tomato crop under glass is then of such a bulk that very little room is left for the circulating air. As this plant demands a dry buoyant atmosphere, it is not surprising that many growers find a difficulty here. The crops fail to set satisfactorily and mould develops. These are some of the troubles due to excessive temperatures and a humid atmosphere. They are found in houses with insufficient ventilation or where ventilation is not given sufficient attention. For this crop generous facility for ventilation along the ridge of the roof is required, and especially is it the case in the warmer latitudes and localities. In such places ventilators in the side walls also would doubtless be of benefit. The water vapour constantly given off on a warm day by large plants planted so closely is very great, and unless it is driven out through the ventilators the atmosphere becomes saturated and the constitution of the plants is affected. Furthermore, where the facilities are available they are, of course, useless unless they are used promptly and intelligently. To allow a house to become overheated and then throw it open to a cold draught is unsatisfactory, and equally distressing to the plants. One who has charge of such glasshouses should be an early riser at this season and make the matter of ventilation his first

consideration. Very soon after sunrise in fine weather ventilation should be given generously before the temperatures rise unduly, the plants are then kept in a hardy vigorous state.

Another important feature is the matter of cultivation. The preparation of the land for planting can hardly be too thorough, but, once the plants are set out and established, hoeing should be done merely to destroy weeds and break up the surface crust if it develops. To cultivate deeply and injure the tender fibrous roots which are so near the surface is to seriously check the plants, and this accounts for many of the thin debilitated crops which are so frequently seen

Tomato-plants for outside cropping should now be carefully hardened off in cradles where they can be covered when necessary. They will generally be benefited by an application of bordeaux spray while still in the boxes. In the warmer localities they may be planted out towards the end of October. They should be planted deeply and firmly in land that has been well prepared and allowed to consolidate. Inspect each plant carefully, and reject those that are undersized or abnormal in any way. A good crop cannot be obtained from poor plants, and a moderate area of good plants is more profitable than a larger area of plants that are uneven.

The Market Garden.

The quality and variety of vegetables displayed for sale in the larger towns during the past winter have been very creditable to the growers. The celery, cauliflower, broccoli, savoys, and brussels sprouts especially have been of nice handy size and excellent condition The movement now on foot to grade the produce and standardize the packages will go a long way towards putting the trade on a better business footing. There then remains the bigger problem of making an even distribution and regular supply in season, so the consumer may form the desirable habit of making more use of these valuable foods. The method of cooking vegetables and serving salads here often leaves much to be desired, and the writers of household notes in papers and magazines would probably require but little encouragement to make a feature of these subjects if growers' organizations would supply them with seasonable information.

The main sowings in the coming month will be the more tender crops, such as marrows, pumpkins, cucumbers, melons, and runner and dwarf beans. Seeds of the important winter crops should also be sown in well-prepared beds for planting out early in the New Year. They include celery, leeks, cauliflower, broccoli, and savoy cabbage. Expensive seed is not always good, but cheap seed cannot be. For commercial cropping no trouble is too great to see that the best seed-strains are obtained.

The Home Garden.

The appearance and comfort of the home garden depend to a great extent on smooth lawns and clean walks. These will require some attention now to keep them in that condition. A good liquid weed-killer, applied with a watering-can with a rose sprinkler attached, is the easiest way of dealing with weeds on walks and drives. If the metal is then raked into position and rolled after a heavy rain it will maintain its shape.

The lawns will require cutting weekly now for awhile. This should be done when the grass is dry, using a mower that is clean, well oiled, and with the cutting cylinder set rather close on the bed-plate. On medium to heavy land moderate use of the roller when the ground is moist will improve the surface of the lawn. On light land more attention of this kind might be given with advantage.

—*W. C. Hyde, Horticulturist, Wellington*

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1929–30.

Dairy Division

LISTS of butter and cheese factory companies or proprietaries which have obtained for their export produce an average grade of 93 points or over for the past dairy year—1st August, 1929, to 31st July, 1930—are here presented. Ninety-three butter-factories and nineteen cheese-factories have gained a place in the lists this year, compared with seventy-five and thirty respectively for 1928–29. It will be noticed that thirty butter-making concerns have gained the highly creditable average of 94 points or over, the highest average grade being 95·245. Only one cheese company, with an average grade of 94·018, reached this level. Of the concerns which have gained a place in the list, seventy-five butter-making and five cheese-making are located in the North Island, and eighteen and fourteen respectively in the South Island.

Company or Proprietor	Registered No.	Brand	Average Grade Points
Butter-factories.			
Rangitikei	1360	Rangitikei	95·245
Wangaehu	1326	Wangaehu	95·187
Taieri and Peninsula (Dunedin)	54	Taieri and Peninsula	95·128
Rata	938	Rata	95·123
Golden Bay	146	Sovereign	95·069
Shannon	1489	Shannon	94·947
Awahuri	664	Red Rose	94·899
Levin	910	Lake	94·833
Rangiwahia	750	Quail	94·765
Rongotea	8	Rongotea	94·591
Lepperton	49	Lepperton	94·563
Arahura	1516	Arahura	94·552
United	1220	Whariti	94·453
Waitaki	812	Waitaki	94·438
Taieri and Peninsula (Oamaru)	1234	Taieri and Peninsula	94·388
Palm	1838	Palmerston	94·362
Moa Farmers'	341	Inglewood	94·329
Kokatahi	1144	Kokatahi	94·303
Farmers' Dairy Federation (Invercargill)	336	Murihiku	94·300
Midhirst	110	Rugby	94·292
Toruiutangi	728	Champion	94·235
Wellington Municipal Milk	202	Rahui	94·217
Tarata	631	Tarata	94·159
Kia Ora	936	Kia Ora	94·153
Mangorei	345	Mangorei	94·094
Whakaronga	1709	Whakaronga	94·087
Taihape	1188	Tikapu	94·062
Tikorangi	102	Shield	94·058
Kaikoura	302	Kaikoura	94·003
Maketawa	342	M.D.C.	93·994
Kuku	905	Ohau	93·983
Apiti	414	Apiti	93·967
Cheltenham	3	Pakeha	93·957
Raetihi	717	Raetihi	93·940
Tolaga Bay	1007	Tolaga Bay	93·900
Waitara	726	Waitara	93·881
Wairoa	1345	Wairoa	93·855

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1929–30—*continued.*

Company or Proprietor.	Registered No.	Brand.	Average Grade Points
Butter-factories—*continued.*			
Murchison	1888	Airship	93·844
Pembroke Road	234	Pembroke	93·839
Tariki	1818	Tariki	93·822
Golden Coast	387	Golden Dawn	93·810
Komni	1203	Konini	93·808
Norsewood	600	Norsewood	93·794
Inter-Wanganui	6	Inter-Wanganui	93·793
New Zealand (Ngatea)	291	Anchor, &c	93·780
Okau	872	Okau	93·776
Lowgarth	629	Lowgarth	93·769
Golden Coast	991	Golden Coast	93·757
Omata	82	Omata	93·701
Kaponga	732	Kaponga	93·646
Kairanga	1768	Longburn	93·636
Uruti	300	Uruti	93·555
Co-operative of Otago	266	Huia	93·509
West Coast Farmers'	675	Silver Pine	93·491
Mangatoki	136	Mangatoki	93·469
Karamea	1570	Karamea	93·428
Heretaunga	1230	Heretaunga, &c.	93·416
Opotiki	337	Opotiki	93·391
Kati Kati	1305	Kati Kati	93·374
Heretaunga (Waipukurau)	1455	Mount Vernon	93·354
Kaitaia	1298	Kaitaia, &c	93·343
Waitoitoi	20	Waitoitoi	93·341
Ngatiporou	395	Nati	93·325
Te Aroha	345	Overseas, &c.	93·300
Cambridge	1239	Cambridge, &c.	93·298
Hokianga	1843	Hokianga, &c.	93·289
Mokau	274	Mokau	93·285
Otaki	1236	Kapiti	93·264
Rangitaiki Plains	133	Rangitaiki Plains, &c.	93·278
Pio Pio	603	Pio Pio	93·265
North Taranaki	723	Flax	93·258
Waipu	1248	Waipu	93·237
Bell Block	488	Bell Block	93·217
Mauriceville	14	Mauriceville	93·211
Caroline	236	Caroline	93·195
Royal Oak	693	Royal Oak	93·184
Kaitieke	1119	Kaitieke, &c.	93·182
Masterton	1307	Masterton	93·169
Kaipara	794	Poplar, &c.	93·161
New Zealand (Waiuku)	111	Anchor, &c.	93·154
Oruru-Fairburn	1337	Fairy	93·150
New Zealand (Otorohanga)	185	Anchor, &c.	93·128
East Tamaki	301	East Tamaki	93·121
Eltham	31	Eltham	93·095
Cape Egmont	632	Cape Egmont	93·094
Farmers' Dairy Federation (Gore)	165	Gore	93·085
New Zealand Farmers' Dairy Union	100	Hinemoa	93·083
Raglan	1470	Raglan	93·075
Springhead	180	Springhead	93·075
Alpine	792	Pine	93·050
New Zealand (Waharoa)	293	Anchor, &c.	93·041
Maungaturoto	1407	Otamatea	93·017
Whangarei	1720	Kauri, &c.	93·008

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1929-30—*continued.*

Company or Proprietor.	Registered No.	Brand.	Average Grade Points.
Cheese-factories.			
Tamaki	58	Tamaki	94·018
Kaiparoro	619	Bruce	93·991
Omimi	71	Omimi	93·573
Stirling	292	Stirling	93·543
Waianiwa	1171	Waianiwa ..	93·538
Ryal Bush	477	Ryal Bush ..	93·531
Dalefield	9	Dalefield ..	93·526
Milton	1030	Milton .. .	93·524
Barry's Bay	401	Onawe	93·512
Edendale	36	Pioneer . .	93·373
Mabel	29	Mabel	93·325
Rapanui	714	Southern Grove ..	93·246
Morton Mains	1604	Morton Mains ..	93·220
Kairanga	1768	Fitzherbert ..	93·206
Tokonui	656	Tokonui	93·160
Pine Bush	543	Pine Bush ..	93·050
Merton	45	Merton .. .	93·043
Momona	1010	Momona .. .	93·041
Awarua	545	Awarua . .	93·040

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 17th July to 11th September, 1930, include the following of agricultural interest.—

No. 62896. Gorse-cutter for tractor; J W Belgrove, Kirwee. No. 63322: Treatment of flax; W J. Butler, Ruatapu. No 63332: Sheep-shearing-machine drive; F. C. McNamara, Auckland. No. 63353: Harrow; A. C. Sutherland, Whakatane No. 62358: Carcass for market; Swift and Co., Chicago, U S.A No. 63008: Controlling growth of horns of cattle; E. C. McDermott, Hastings. No. 63040: Harrow; A. C. Sutherland, Whakatane. No. 63062: Manure-distributor; A. W. Stuckey, Morrinsville. No. 63509: Brooder; W. I. Hunter, Patumahoe. No. 63859: Cleaning pipes of milking-machine; R. G. Carrie, Te Rapa. No. 64125: Lifting and stacking hay; H. G. Wine and J. F. Batley, Tirau. No. 65147: Labelling cheese; W. C. Bagrie, Seaward Downs. No. 63321: Removing manuka and gorse; J Teschemaker-Shute, Mangatahi, H. B Tennent, Hawke's Bay, and E. Fraser, Hastings. No. 64320: Manure-distributor; Hill Top Dressers, Ltd., Masterton. No. 63239: Concrete fencing-post; P. J. Marfell, Waipukurau. No. 63467: Shearing-machine comb-plate; J. Davidson, Sydney, N.S.W. No. 64997: Milking-machine releaser; R. F. Mehrtens, Te Aroha. No 63098: Wool-baling press; R B. D Walker, Blenheim. No. 65153: Scarecrow, W. Griffiths, Auckland. No. 63558. Chain harrow; Booth, MacDonald, and Co., Ltd, Christchurch No. 63614: Foot-rot treatment; G. V. Fry, Homewood, Vic. No. 63681: Administering animal drench, L M. Jones, Manutuke. No. 64235. Milking-machine; W. R. Cockburn, Awhitu. No 64950: Milk or cream cooler; J. Paterson, Invercargill. No. 65057: Manure-distributor; J. W. Yarnall, Wellington. No. 65393: Egg-handling machine; W. Hilgers, Dusseldorf, Germany.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

REVIEW.

Perennial Rye-grass at Aberystwyth, by T. J. Jenkin, M.Sc., Welsh Plant Breeding Station, Aberystwyth, in the *Welsh Journal of Agriculture,* Vol. VI, 1930, pp. 140–165.

THE author deals with specific investigations conducted at the Welsh Plant Breeding Station, Aberystwyth, on perennial rye-grass samples drawn from all over the world. The earlier publications of 1919–21 are reviewed, and it is pointed out that the distinction between British indigenous rye-grass and commercial rye-grass from other sources is still retained—the former have proved to be better suited than the latter to British pasture conditions The present report deals with the rye-grass investigation over the ten-year period 1919–29.

The author emphasizes the essential need for single (spaced) plant studies in regard to pedigree-strain building in rye-grass, an important implication wholly confirmed by the New Zealand work of Levy and Davies. Tables given in the paper show that under Aberystwyth conditions Hawke's Bay rye-grass is outyielded only by pedigree Aberystwyth-bred lots

Of further interest to New Zealand are the author's comments on this country's rye-grass as a whole. The following are extracts from the paper. "New Zealand rye-grass at its best may at once be stated to be very good; at its worst it is very bad. In fact, two rather distinctive sub-groups must here be recognized. . . In the first sub-group must be placed Hawke's Bay, Poverty Bay, and to some extent Sandon. These may be referred to as Class A. In the second group has been placed [seed from] Sandon, Canterbury, and Southland districts, together with a few lots of unknown origin. These may be referred to as Class B . . The fact that these two extreme classes exists under the name "New Zealand" is of grave importance both to the British agriculturist and to the export trade of the Dominion. . . Poverty Bay [and Hawke's Bay] seed already commands a higher price than Southern on the New Zealand market. It therefore follows that when seed is available for export to this country [Britain] it will very largely be of the inferior "Class B" type . . and will probably find a ready sale—to the detriment of British agriculture and eventually of the Dominion's export trade. . . . The British farmer can with every confidence be urged to use Class A New Zealand seed, and with equal confidence to reject Class B New Zealand seed. If . . one might presume to offer advice to the Dominion in the matter of exporting seed to this country it would be, 'Do not export any of the Class B type; export only seed from such area as produce Class A type, and see that in these areas the poor types are rigidly excluded' . . ."

The author then discusses the origin of what he terms Class A and Class B rye-grass, and concludes that Class A (the true perennials of Levy and Davies) is representative of the best types in British commercial seed, and by so much is superior to British commercial This is not in complete agreement with the New Zealand work, where British commercial lots under test have shown quite close affinities with some of the false perennials (Class B).

The suggestions made relative to the origin of Class B rye-grass (the false perennial of the New Zealand workers) are interesting, and most probably accurate. It is concluded that Class B lots are derivatives, firstly, of selection of the most lax types in British commercial, and, secondly, by the intercrossing of these with Italian rye-grass. Similar conclusions have been arrived at by Levy and Davies in New Zealand

The discussion dealing with Australian "Wimmera" rye-grass is only of secondary interest to New Zealand. The author shows that Wimmera rye-grass as found in commerce shows very close affinity with Class B, or the false perennial of New Zealand.

Comparing the Aberystwyth work under review and the similar studies now being conducted at the Plant Research Station at Palmerston North, there is found quite close agreement. The Aberystwyth work has the advantage of intensive study over a ten-year period, whereas the Palmerston

North work is considerably younger The work emphasizes what is already apparent at the New Zealand end—that we have little to gain by wholesale importations of commercial rye-grass seed from overseas countries. The domestic rye-grass-strain position can be most rapidly improved and to some degree righted by the careful earmarking of our best true perennials of "Type 1" as defined by Levy and Davies, followed by an extensive and well-controlled scheme of "once growing" our best types. The report as a whole is on eminently sound lines

In the fostering and the development of New Zealand as an Imperial source for the production of the best possible strains of herbage plants it is incumbent upon the Dominion to know the exact requirements of the consuming country, and in this respect the Aberystwyth Station can be of great assistance in the determination of and reporting upon types that may be particularly suitable to the needs of the British farmer.

CERTIFICATION OF SEED POTATOES.

CERTIFICATES ISSUED ON FINAL TUBER INSPECTION, AUGUST, 1930.

Aucklander Short-top (N Z Sutton's Supreme).

Weeber Bros , Belfast.
F. Brundell, Camside, Kaiapoi
J. Jellie, Russley Road, Fendalton
W E Martin, R M D., East Eyreton
G. Harris, Milford, Temuka.
A. J. Rich, R.M.D., Kaiapoi.
W. Oakley, R.M.D., Halkett.
D. Marshall, R.M D., Killinchy.
J. Rouse, Pareora, via Timaru.
R. Barnett, Dunsandel.
T. O'Brien, St. Andrews.
A. D. Carroll, R.M D , Southbridge.
C. Redmond, R M.D., Kimberley.
C. H. Jordan, R M.D., Kaiapoi.
M. Breen, Levels.
Mufi Bros., Orari.

Aucklander Tall-top (N.Z. Sutton's Supreme).

Weeber Bros , Belfast.
J Warren, Russley Road, Fendalton.
H. S. Moore, Box 4, Kaiapoi.
J. Bailey, R.M.D., Kaiapoi

Epicure.

D. Marshall, R.M.D , Killinchy.
W. Shellock, R.M.D., Mead, Rakaia.
G. McLachlan, R M.D., Southbridge.

Dakota

H M. Marshall, R.M D., Weedons.
W. A. McPhail, Mitcham, Rakaia.
W. Gee, Springlands, Blenheim.
W J. Crozier, Mitcham, Rakaia.
E. Hinton, Templeton.
S. Cross, R.M.D., Rolleston.
C E. Walker, R.M.D., West Melton.
Munro and Scarth, Lavington, Rakaia.
J. H. Doak, Barr Hill, Rakaia.

Robin Adair.

D. Marshall, R.M.D., Killinchy.

Majestic.

A J Clark, Box 34, Rangiora
C. H. Wilson, Lorneville, Invercargill.

Arran Chief.

G. Jones, "Vale Royal," Halswell.

Early Regent.

M. Kelly, 502 Lincoln Road, Halswell.
Jas Curragh, Templeton.

King Edward.

L. King, Glencoe R M.D., Invercargill.
A. Anderson, Stirling.
J. McLeary, Mataura Island.
O. S. Mosley, Stirling.
A. H. Rose, Glencoe R.M.D., Invercargill.
C. E. Knowler, Tuatapere.
R. M. King, Tuatapere.

Iron Duke.

H. A. Hancock, Awahuri, Palmerston North.

Golden Wonder.

J. Warren, Russley Road, Fendalton.

Up to Date.

H. D. Norman, Tuatapere.
C. E. Walker, R M D., West Melton.

Breese's Prolific.

D. Marshall, R.M.D., Killinchy.

NOTE.—See also previous lists published in the *Journal* for May, July, and August, 1930.

WEATHER RECORDS: AUGUST, 1930.

Dominion Meteorological Office.

GENERAL NOTES.

METEOROLOGICALLY, August in New Zealand is generally considered to be the last of the winter months, but the one just passed was characterized by distinctly spring-like weather, more especially during the latter half. Temperatures were cold in the early part of the month, when some rather severe frosts occurred at places most subject to them, but on the whole conditions were mild for the time of the year. Rainfall exceeded the normal in nearly all parts of the North Island. At a few places in Auckland Province, however, there was a deficiency. In the South Island the totals were above normal in the eastern portion from Marlborough to Dunedin, while in all the western half and the greater portion of Otago and Southland they were below. At Nelson City the amount of rain recorded during the past three months has been the lowest for this period since records were commenced in 1883. Owing to an almost continued low rainfall since January, the subsoil in Central Otago has become dry for a considerable depth.

The mild temperatures and the ample rainfall induced a marked growth of pastures in most districts Compared with the corresponding time of last year the season is in this respect further advanced. Consequently stock generally were reported to be in good condition, and at the close of the month the prospects for the lambing season and for dairying appeared excellent.

The finest weather occurred between the 13th and 23rd, the only interruption being due to the passage of a shallow cyclone over the South Island on the night of the 16th and during the 17th, when fairly general but light rain fell.

The most notable pressure disturbance affecting the Dominion during the month was an intense and extensive cyclone, which, advancing over the northern Tasman Sea on the 3rd, moved gradually on to New Zealand. Its central portion crossed the Cook Strait region during the night of the 6th, and barometer readings were very low while it was passing. On the morning of the 6th Chatham Island reported a pressure of 28·9 in. General rains occurred during the 4th and 5th, with many heavy falls. Three days of almost ceaseless rain at Christchurch caused surface-water to accumulate in many parts of that city, and rather severe floods were experienced in the area through which the Heathcote River flows.

Another cyclone, but a much shallower one, brought dull misty weather between the 9th and the 12th, mainly to the North Island and the eastern portion of the South Island. Though the rain was mainly light, some heavy falls occurred during the 10th and 11th between Hawke's Bay and Castlepoint, and some flooding resulted.

From the 24th to the close of the month much dull and misty weather prevailed, this being associated with several small cyclones which crossed the Dominion. The rainfall during this period was chiefly light and scattered, but on the 24th and the 28th more general rain was experienced with a few heavy falls. Wellington, for instance, had 152 points for the twenty-four hours preceding 9 a.m. on the 25th, the heaviest fall recorded in the city so far this year.

Fortunately, strong winds were infrequent, and the month on the whole was consequently a mild and pleasant one.

RAINFALL FOR AUGUST, 1930, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	0.76	17	1.41	5.10
2	Russell	4.20	15	0.96	5.55
3	Whangarei	5.29	17	1.07	6.90
4	Auckland	3.39	15	0.65	4.26
5	Hamilton	3.00	16	0.78	4.02
5A	Rotorua	6.31	14	1.47	4.97
6	Kawhia	4.29	11	0.90	4.54
7	New Plymouth	9.54	17	2.76	5.37
8	Riversdale, Inglewood ..	10.68	17	3.22	8.65
9	Whangamomona	6.12	14	1.25	5.83
10	Eltham	6.88	15	1.35	3.82
11	Tariua	5.31	16	1.99	6.33
12	Tauranga	5.58	18	2.12	4.29
13	Maraehako Station, Opotiki	8.54	16	1.52	5.20
14	Gisborne	6.08	17	1.65	4.39
15	Taupo	5.72	17	1.05	4.06
16	Napier	4.29	13	1.23	3.54
17	Hastings	5.80	16	1.50	3.27
18	Taihape	3.41	13	1.43	2.80
19	Masterton	5.38	14	0.94	3.48
20	Patea	4.30	14	1.48	3.50
21	Wanganui	4.04	8	1.34	2.73
22	Foxton	3.16	14	1.20	2.89
23	Wellington (Karori Reservoir)	4.83	17	1.80	4.35
	South Island.				
24	Westport	4.83	15	1.04	7.70
25	Greymouth	4.94	13	1.46	7.38
26	Hokitika	8.62	13	2.96	9.29
27	Ross	8.11	14	3.61	10.40
28	Arthur's Pass	8.75	8	2.83	12.78
29	Okuru	11.27	15	2.09	11.46
30	Collingwood	..	..	..	6.06
31	Nelson	2.83	11	0.95	3.03
32	Spring Creek	3.97	13	1.03	2.73
33	Tophouse	3.01	11	0.52	4.64
34	Hanmer Springs	2.54	14	0.81	3.09
35	Highfield, Waiau	3.84	10	1.18	2.26
36	Gore Bay	4.52	10	1.63	2.12
37	Christchurch	3.64	12	1.00	1.83
38	Timaru	3.00	11	1.22	1.41
39	Lambrook Station, Fairlie ..	1.96	8	0.84	1.43
40	Benmore Station, Clearburn	1.76	8	0.65	1.45
41	Oamaru	3.33	13	1.54	1.71
42	Queenstown	1.35	9	0.36	1.93
43	Clyde	0.37	5	0.09	0.80
44	Dunedin	3.46	14	1.09	3.14
45	Wendon	0.47	6	0.14	2.26
46	Gore	..	..	..	2.31
47	Invercargill	2.04	14	0.38	3.31
48	Puysegur Point	6.04	19	1.30	7.20
49	Half-moon Bay	2.00	11	0.29	4.35

—*Edward Kidson, Director of Meteorological Services, Wellington, 6/9/30.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

HAND-REARING OF LAMBS.

"INQUIRER," Pihautea :—

Would you kindly advise me the best method of rearing a lamb on cow's milk, and what quantity to give at a feeding? I have been using three parts of milk and one of water, but find the lamb very constipated

The Live-stock Division :—

The successful hand-rearing of lambs on cow's milk is generally a fairly easy matter, provided care is taken to see that the young animal is fed a limited amount of milk at frequent intervals As the lamb becomes older the intervals between feeding can be increased Young lambs require about two or three tablespoonfuls of cow's milk every two or three hours during the first few days. The milk should be selected from a cow giving a good butterfat test, or if such cannot be obtained a little cream should be added to whole milk. The milk should be placed in a bottle the mouth of which is covered with a medium-sized nipple, and the whole warmed to blood heat before being fed. The nipple and bottle should always be carefully cleaned, or digestive trouble may result Skim-milk should not be used, nor should water be added to cow's milk. Ewe's milk contains a higher percentage of fat than cow's milk, and no doubt the constipation you mention resulted from using cow's milk diluted with water.

MINERAL LICKS FOR DAIRY COWS.

WILLIAMS BROS., Otane :—

We wish to make up a loose iodized salt-lick for dairy cows, and would be much obliged if you could give the ingredients and their proportions for a lick, also containing the other minerals most often lacking in the soil. We have tried several licks which are on the market but find them very expensive feeding. Further, would it not be possible to have an iodized lick without salt, and to feed rock salt separately? The cows seem to go for the made-up licks more for the salt than the other minerals. If salt was necessary, could it not be in a small proportion, just enough to make the lick liked by the cattle?

The Live-stock Division :—

With regard to the question of licks for stock, minerals provided in this manner can only be considered as supplementary to the amount of minerals in the pasture. There is no doubt that top-dressing not only increases the amount of feed, but also supplies feed rich in mineral content. The minerals required in largest amounts by dairy cows are calcium (lime) and phosphorus Sodium and chlorine are supplied by rock salt. It is usual to add a small percentage of iron If iodine is necessary, in many districts this mineral is required in very small amount. It is not an easy matter to prescribe iodine other than as iodized salt This is prepared by dissolving 3 oz. iodide of potassium in ½ pint water and spraying this over 100 lb salt during mixing. The actual daily dose of iodine is very small, and in this manner the dose can be regulated A mineral lick which would probably meet your requirements for dairy cows is made up as follows Common salt, 28 lb.; sterilized bone-flour, 50 lb; air-slaked lime, 20 lb; sulphate of iron, 2 lb.; potassium iodide. 3 oz. As already mentioned, the iodide is dissolved in ½ pint of water and sprayed over the other ingredients during mixing. The lick is placed in boxes protected from the weather and within easy reach of the stock. Occasionally stock do not take readily to bone-flour. Salt is added with a view to increasing the consumption of bone-flour, which contains the most essential minerals—calcium and phosphorus.

TRIMMING OF LAWSONIANA.

C. E. BOWRON, Pt. Omer, via Picton :—

I should be glad if you would advise me as to trimming Lawsoniana for making a hedge. How old should the trees be, before trimming, and at what time of year they should be trimmed?

The Horticulture Division :—

Cupressus Lawsoniana is most suited for a shelter hedge 12 ft. or 15 ft., and it then requires little or no pruning, as it is naturally clothed with branches about the base. If you desire to establish a hedge lower than this, cut off the leading growth as it attains the desired height (not before), and prune the side branches in to the desired width. These operations should be performed just before growth commences on young plants; otherwise, the autumn, about the month of April, is very suitable.

ENSILAGE FOR DAIRY COWS.

J. D., Westmere :—

We are feeding freshly calved cows on hay at night and ensilage in the morning. What is a full ration of ensilage for a newly calved cow? Can they come to any harm by eating as much of it as they want through the day?

The Live-stock Division :—

A full ration of ensilage for a dairy cow would average from 50 lb. daily upwards, depending upon the breed of the animal and the amount of roughage and other feed available. Dairy cows milk well on ensilage, and provided the quality is above suspicion, no harmful results may be expected. The practice of feeding hay together with ensilage is one to be commended. If the ensilage has been prepared from very young crops more hay is desirable. The feeding-value of grass silage compared with roots and hay has been tested, and is stated as follows: Silage is superior in feeding-value to meadow hay and roots where it replaces them on a basis of 8½ lb. of grass silage to 10 lb. of mangels plus 1 lb. of meadow hay.

AGRICULTURAL SHOWS, SEASON 1930-31.

THE following show-dates have been notified by agricultural and pastoral associations :—

Ellesmere A. and P. Association: Leeston, 16th October, 1930.
Hawke's Bay A. and P. Society: (**Royal Show**), Tomoana, 21st to 23rd October.
Poverty Bay A. and P. Association: Gisborne, 28th and 29th October.
Wairarapa A. and P. Association: Carterton, 29th and 30th October.
Timaru A. and P. Association: Timaru, 29th and 30th October.
Marlborough A. and P. Association: Blenheim, 31st October and 1st November.
Manawatu A. and P. Association: Palmerston North, 5th, 6th, and 7th November.
Northern A. and P. Association: Rangiora, 7th November.
Wanganui A. and P. Association: Wanganui, 12th and 13th November.
Canterbury A. and P. Association: Christchurch, 13th and 14th November.
Egmont A. and P. Association: Hawera, 19th and 20th November.
Stratford A. and P. Association: Stratford, 26th and 27th November.
Otago A. and P. Society: Dunedin, 26th and 27th November.
Nelson A. and P. Association: Richmond, 28th and 29th November.
Wyndham A. and P. Society: Wyndham, 5th December.
Southland A. and P. Association: Invercargill, 9th and 10th December.
Helensville A. and P. Association: Helensville, 29th January, 1931.
Feilding A. and P. Association: Feilding, 3rd and 4th February.
Masterton A. and P. Association: Solway, 17th and 18th February.
Marton A. and P. Association: Marton, 25th February.
Auckland A. and P. Association: Auckland, 26th, 27th, and 28th February.
Taranaki Agricultural Association: New Plymouth, 4th and 5th March.
Waikato Central Agricultural Association: Cambridge, 4th and 5th March.
Mayfield A. and P. Association: Mayfield, 14th March.
Methven A. and P. Association: Methven, 28th March.

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DAIRY-HERD TESTING IN NEW ZEALAND.

REVIEW OF THE 1929–30 SEASON.

W. M SINGLETON, Director of the Dairy Division, Wellington.

THE season of 1929–30 must be regarded as an outstanding period in the herd-testing movement of New Zealand, having witnessed the first year's work of the Herd-testing Central Executive and of the Federation Supervisor of Herd-testing, while it was also marked by a larger number of cows under test and a higher average butterfat-production than has been hitherto recorded.

Already the Central Executive has accomplished much by way of formulating policies for improving and extending the movement, and has also suggested alterations to the method of allocating future subsidies, which, if put into operation, should be of considerable assistance to weak and newly formed organizations. The Federation Supervisor has paid visits to practically every district in New Zealand, and, apart from bringing about many improvements and economies in the working of existing groups and associations, and standardizing practice generally, he has been successful in increasing the membership of several groups, as well as assisting the establishment of a number of new groups in districts where no systematic herd-testing was previously being done. There has been, in fact, a representative and systematic supervision of the entire operations.

Returns received indicate that 283,731 cows were tested in 1929–30, an increase of 24,137 over the 1928–29 total of 259,594. Last year's number represents 20·4 per cent. of the total of the Dominion's dairy cows in milk, or 19·7 per cent. of all cows—in milk and dry. The increased total is the result of more group testing, the other branches of ordinary herd-testing having shown a falling-off.

Group herd-testing has shown remarkable progress. The system was inaugurated in 1922, and commenced with six groups comprising 7,500 cows. During the season 1922–23 there were 84,825 cows on test in the Dominion, so that the group quota was only 8·84 per cent. of the total. Each year has shown an increase in group testing, until for the season under review there were 184 groups in operation with a total of 242,688 cows, or 85·5 per cent. of grand aggregate of cows tested.

Table 1.—Number of Cows tested Twice or more, classified according to Season and System of Testing.

System.	1925–26.			1926–27.			1927–28.			1928–29.			1929–30.		
	Organizations.	Cows	Average Cows per Organization.	Organizations.	Cows.	Average Cows per Organization.	Organizations.	Cows.	Average Cows per Organization	Organizations.	Cows.	Average Cows per Organization.	Organizations.	Cows.	Average Cows per Organization.
Association	124	59,345	479	116	56,823	489	115	56,699	493	99	45,586	460	98	40,667	415
Group ..	86	105,227	1,224	96	109,827	1,144	127	164,610	1,296	158	212,480	1,344	184	242,688	1,319
Dairy Company	38	5,204	137	28	3,500	125	18	2,821	157	8	1,528	191	6	376	63
All ..	248	169,776	685	240	170,150	709	260	224,130	862	265	259,594	979	288	283,731	985

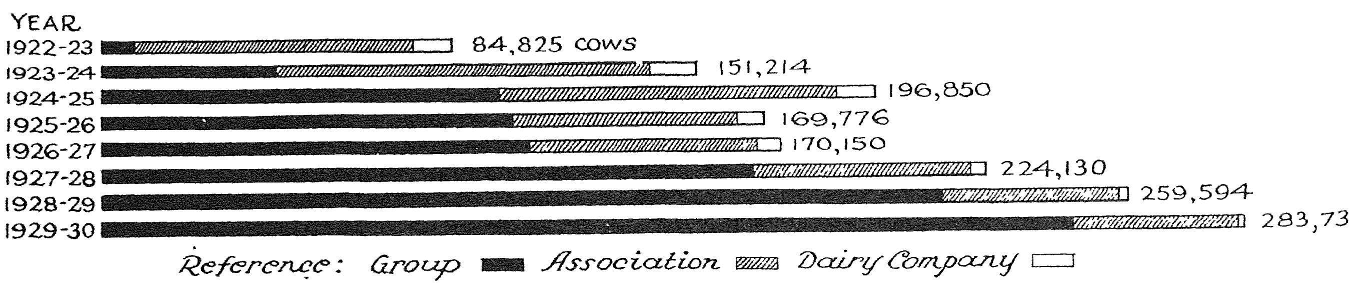

FIG. 1. GRAPHICAL REPRESENTATION OF EXTENT AND SYSTEMS OF HERD-TESTING IN NEW ZEALAND FOR LAST EIGHT SEASONS.

The statistical survey which follows adheres to the procedure usually followed in the presentation of our annual herd-testing review. It does not pretend to be more than a summary of results for cows tested in the Dominion It is impossible to take into consideration the finer details of the subject—that is to say, the different rules and bases of figuring recognized by different organizations, details as to the varying classes of cows and of land throughout the various districts, land-values, detailed climatic conditions, and other points which would be essential to make the review entirely complete and authoritative. The three main terms adopted in the past have been retained—namely, "Group," "Association" (sometimes called "Individual," and lately changed to "Association Own-sample Test" on the recommendation of the Central Executive), and "Dairy Company." Under the group system a testing-officer visits the farm and takes samples one day a month, whereas under the Association and Dairy Company systems the owner takes his own samples, usually for two days a month, and the association officer or the dairy-company manager arranges for the testing.

A classification under these three systems is given in Table 1, five seasons being shown for purposes of comparison. The table indicates the position outlined in our introductory remarks, and makes it quite clear that the group system has increasingly dominated the movement, until the other systems combined claim a relatively small percentage of the total number of cows tested. The graph shown beneath the table covers the period since the inauguration of the group system in 1922–23, and is interesting from the point of view of indicating the proportion of support accorded to each of the three systems named.

The past season showed an increase in the number of cows tested in every land district except Southland and Canterbury. Westland was again the only land district in which no systematic herd-testing was carried out. In next year's review, however, we hope to be able to make a more favourable report on this area. Five groups have now been formed in Westland, and we look forward with interest to reviewing the result of their first season's operations. Nelson and Marlborough, and particularly Otago, have shown creditable increases.

Table 2 provides a statistical summary of the number of cows tested in each of the various land districts. This year we are able to add a column showing the percentage which the tested cows bear to the total cows in milk. The most striking points are the comparatively low position of Taranaki, in the North Island, and that in the South Island those districts which might be considered the more specialized dairying region test a relatively small proportion of their cows.

Table 3 affords a general review of the number and size of the various organizations operating throughout the year, and it is interesting to note that there is an advancement under practically every heading. Seeing that practically all the organizations are Group it is not reasonable to expect much alteration under the fourth heading, as the number of herds per group is governed by workability. For the benefit of those readers who are not conversant with the subject it may be explained that the term "organization" as here used denotes any herd-testing

Table 2.—Number of Cows tested Twice or more, classified according to Season and Land District, &c.

Land District, &c.	1925-26	1926-27.	1927-28.	1928-29.	1929-30.	Percentage of Tested Cows to Total Cows in Milk, 1929-30.*
North Auckland .	24,051	24,616	41,067	48,713	58,113	24·5
Auckland .. .	77,651	82,338	101,796	106,823	109,811	26·8
Gisborne .. .	3,891	2,626	5,756	9,579	12,329	33·4
Hawke's Bay ..	4,902	2,987	4,638	8,243	8,505	17·0
Taranaki .. .	16,485	14,696	23,581	30,298	31,693	15·1
Wellington	29,653	29,517	32,267	36,547	42,224	21·1
North Island .	157,533	156,780	200,105	240,203	262,675	23·0
Nelson .. .	880	620	656	1,241	2,128	8·0
Marlborough ..	441	258	434	2,176	3,628	23·7
Westland	..	74	..	..	..	..
Canterbury .	1,799	4,292	3,280	3,524	2,816	3·8
Otago	903	950	769	581	2,975	5·7
Southland ..	8,220	7,176	9,886	11,869	9,509	13·7
South Island ..	12,243	13,370	15,025	19,391	21,056	8·5
Dominion	169,776	170,150	224,130	259,594	283,731	20·4

* As at 31st January, 1930.

body, whether Group or Association. Moreover, the term applies to each individual unit—that is to say, an organization operating ten groups would be included as ten, not as one. It will be observed that the number of cows per herd is steadily increasing. The explanation is not so much that our herds are increasing in size, but rather that practically all group organizations insist upon every normal cow in the herd being tested. By an "effective" summary is meant that the table is compiled from individual summaries sufficiently complete and reliable to justify inclusion.

Table 3.—Number of Cows, Herds, and Organizations represented in Effective Seasons' Summaries received. (Basis : All Cows in Milk 100 Days or over.)*

—	1927-28.	1928-29.	1929-30.
Number of organizations	242	257	282
Number of herds	5,927	6,663	7,107
Number of cows	206,323	245,811	272,554
Average number of herds per organization	24	25	25
Average number of cows per herd ..	35	36	38
Average number of cows per organization ..	853	956	967

* Including both Group and Association systems, and on basis of sections or units.

Table 4 provides a classification of groups and associations according to herds and cows. The most noticeable feature is the marked decrease in the average size of the associations.

Table 4.—Average Size of Associations and Groups for which Effective Seasons' Summaries on the Basis of all Cows in Milk 100 Days or over were received.

System	Season.	Average Number of Herds per Association or Group.	Average Number of Cows per Association or Group.	Average Number of Cows per Herd.
Association ..	1925–26	19	407	22
	1926–27	18	408	22
	1927–28	21	414	20
	1928–29	20	401	19
	1929–30	20	363	19
Group ..	1925–26	27	1,205	44
	1926–27	26	1,127	43
	1927–28	28	1,250	45
	1928–29	29	1,304	44
	1929–30	28	1,288	46

Table 5 supplies a grand summary of production results for the past two seasons, the figures being taken out under the separate as well as the combined headings of Group and Association. It will be noted that the average yield for all tested cows has risen from 240·50 lb. butterfat in 1928–29 to 253·61 lb. in 1929–30. This is an exceedingly satisfactory increase, more particularly as the position can scarcely be credited to climatic conditions

Table 5.—Grand Summary of all Effective Herd-testing Results on the Basis of all Cows in Milk 100 Days or over received for the Last Two Seasons.

—	1928–29.			1929–30.		
	Number of Cows.	Days in Milk.	Butterfat-production	Number of Cows.	Days in Milk.	Butterfat-production.
			lb.			lb.
Average for all cows	245,811	242	240·50	272,551	247	253·61
Highest Group average ..	984	276	304·71	1,113	281	318·42
Lowest Group average ..	3,190	215	170·40	1,025	194	173·96
Highest Association average ..	105	273	358·50	5	293	440·93
Lowest Association average ..	190	140	131·76	108	143	150·04
Highest Group herd	21	329	428·00	7	275	455·43
Lowest Group herd	34	111	83·00	15	117	78·46
Highest Association herd ..	1	322	475·70	5	288	485·54
Lowest Association herd ..	10	120	77·13	12	139	71·19
Highest Group cow .. .	.	305	888·00	..	350	886·00
Lowest Group cow	..	105	8·00	..	130	11·00
Highest Association cow ..	..	350	704·20		285	639·00
Lowest Association cow ..	..	120	19·02	..	100	20·00
Average daily production of butterfat for all Group cows	.	..	0·98	.	..	1·01
Average daily production of butterfat for all Association cows	..	..	1·05	..	..	1·11

The collection of data necessary to compile a table of this nature, and in fact the majority of the tables given in this survey, entails considerable work on the part of the officers in charge of the various herd-testing organizations. The effective summaries received for the past season represent 96·3 per cent. of the total number of cows tested twice or more, the highest percentage we have yet been able to record. We

should once more like to express appreciation for the service which the persons concerned have so willingly and courteously rendered. The systematic and comprehensive recording of returns and the subsequent sifting and analysing is a very important factor in the success of the herd-testing movement.

The increase in the production of the average tested cow is better appreciated after a study of Table 6. This table covers the past five years as regards the dairy-cow population of New Zealand. This year we have added a column showing the percentage of dry cows to total cows, and it will be noticed that in the five-year period the percentage has decreased from 9·38 to 3·57. There were 97,688 more cows milked last season than the season before, despite the fact that the total cows increased by only 69,255, a decrease of 28,410 being recorded in dry cows. This, taken in conjunction with the increased average production per cow, represents in itself a very substantial increase in butterfat production.

Table 6.—Cows in Milk and Dry.

Season.	Total Cows.	Cows in Milk	Dry Cows.	Percentage of Dry to Total Cows.
1925–26 ..	1,303,856	1,181,441	122,415	9·38
1926–27 ..	1,303,225	1,181,545	121,680	9·33
1927–28 ..	1,352,398	1,242,729	109,669	8·10
1928–29 ..	1,371,063	1,291,204	79,859	5·82
1929–30 ..	1,440,321	1,388,872	51,449	3·57

Table 7, which embraces four years, classifies the production of tested cows according to system of operation, the two principal systems —namely, Group and Association—being shown. The Association system shows a falling-off under each heading except the two important ones of average days in milk and average butterfat, while there is a considerable increase under each Group heading. The steady advance of the length of the average lactation is a gratifying feature. In perusing this table two points immediately attract attention. Firstly, the Association yield is higher in relation to days in milk, and, secondly, the average days in milk for Group cows is twenty-eight days

Table 7.—Average Production of all Effective Results for Past Four Seasons classified according to System. (Basis. All Cows in Milk 100 Days or over.)

Season.	System.	Number of Associations or Groups.	Number of Herds.	Number of Cows.	Average Days in Milk.	Average Butterfat.
						lb.
1926–27 ..	Association	115	2,140	46,878	220	232·64
	Group ..	96	2,538	108,150	241	243·88
1927–28 ..	Association	115	2,389	47,589	204	212·07
	Group ..	127	3,538	158,734	237	228·46
1928–29 ..	Association	99	2,000	39,722	222	234·33
	Group ..	158	4,663	206,089	246	241·69
1929–30 ..	Association	98	1,921	35,613	223	248·88
	Group ..	184	5,186	236,941	251	254·32

more than for Association cows. The explanation of the first point mentioned lies probably in the fact that in many instances only selected cows from the better herds are placed under Association test, whereas, speaking broadly, Group rules provide that the entire herd must be entered for test. The more complete recording system, and the fact that the testing officer's visit more or less compels the taking of samples and milk-weights until drying off would doubtless explain the longer Group-testing period.

In Table 8 average production has been classified on the basis of all cows in milk 100 days or more and 210 days or more. This summary applies only to those associations conducted by the Dairy Division's testing officers and the returns figured at the Division's headquarters. It is necessary to know the average production of all tested cows, irrespective of length of lactation, and no summaries are truly representative unless taken out on this basis On the other hand, it is interesting to know the production of what may be termed the average normal cow, or, in other words, the average production

Table 8.—Average Production for Associations conducted by Officers of the Dairy Division, comparing Difference in Production between Results of Summaries compiled on the Basis of all Cows in Milk 100 Days or more and 210 Days or more.

Year.	100 Days or more.		210 Days or more.	
	Average Days.	Average Butterfat.	Average Days.	Average Butterfat.
		lb.		lb.
1925–26	218	221·19	257	259·20
1926–27	236	247·35	262	273·36
1927–28	229	246·91	264	282·54
1928–29	242	264·77	268	291·89
1929–30	250	278·59	269	300·20

of cows milking a normal number of days. In this table, for 1929–30 there were 4,388 cows in the 100-days-or-more classification, and 3,534 of these qualified for the 210-days section. The outstanding feature of the table obviously lies in the rapid upward trend of the average days in milk for the 100-days-or-more cows. Naturally, average production has increased in proportion to the lengthening of the lactation. In 1925–26 there were thirty-nine days between the two periods, whereas last year the difference was only nineteen days. It is also apparent that our increased average milking period has come about by the elimination of the short-distance milkers, the trend being distinctly toward a more standardized lactation.

Table 9 enables a comparison to be made of average butterfat-production according to land districts, four seasons being shown for purposes of comparison. This table is interesting, but to be of the maximum value must be read with an understanding of conditions obtaining in the various districts. Without a knowledge of details concerning classes of land, land-values, climate, dairy-farming conditions, and other matters which influence the subject the bare figures may not be appraised at their true value.

Table 9.—Average Production, according to Land Districts, &c., of all Cows under Herd-test for which Effective Seasons' Summaries were obtained. (Basis : 100 Days or over.)

Land District, &c.	1926–27.			1927–28.			1928–29.			1929–30.		
	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary	Average Days in Milk.	Average Butterfat.
			lb.			lb			lb.			lb
North Auckland	21,471	224	232·46	36,395	211	191·66	45,735	234	222·87	55,458	245	241 15
Auckland	78,625	240	244 82	95,799	235	225·04	102,239	247	238·27	106,549	256	260·27
Gisborne	2,405	217	218·08	5,244	231	234 39	9,045	233	230·45	11,606	236	234·62
Hawke's Bay	2,285	230	208·95	4,107	230	233·72	7,705	243	249·61	8,281	221	258·06
Taranaki	12,857	241	239·67	22,180	238	247·01	28,515	249	259·76	30,366	254	271·59
Wellington	25,400	258	256·53	29,300	233	244·89	34,524	243	257·93	40,343	242	246 80
North Island	143,043	240	252·29	193,025	230	224·72	227,763	243	240·92	252,603	249	254 03
Nelson	261	233	239·27	341	154	162·44	936	203	237·00	1,976	225	255·15
Marlborough	..	..	..	..	..	..	1,956	217	244 84	3,417	224	250·76
Westland	..	..	..	..	..	..	..	..	..	..	..	..
Canterbury	3,917	207	219·03	2,847	226	222·57	3,081	218	237·67	2,566	206	237·65
Otago	820	199	247·02	720	239	273·42	552	219	253·99	2,790	227	244·41
Southland	6,987	217	215·36	9,390	220	222·94	11,523	225	231·89	9,262	227	249 92
South Island	11,985	213	219·06	13,298	221	224·04	18,048	222	235·22	19,951	224	248·27
Dominion	155,028	238	240·48	206,323	230	224·68	245,811	242	240·50	272,554	247	253 61

Table 10.—Distribution of Records for all Tested Cows in the Dominion represented in Effective Annual Summaries received, Seasons 1928–29 and 1929–30. (Basis : 100 Days or over.)

System.	Class Limits (in Pounds of Butterfat).																		Total Number of Cows classified
	Under 50.	50–100.	100–150.	150–200.	200–250.	250–300.	300–350.	350–400.	400–450.	450–500.	500–550.	550–600.	600–650	650–700.	700–750	750–800.	800–850.	850–900.	
1928–29.							*Numbers.*												
Association	32	1,132	4,780	8,075	9,414	7,830	4,883	2,363	843	265	79	17	6	2	1	..	..	..	39,722
Group ..	468	5,384	17,993	38,032	51,229	45,775	28,341	12,811	4,440	1,230	299	67	15	2	..	2	..	1	206,089
Both ..	500	6,516	22,773	46,107	60,643	53,605	33,224	15,174	5,283	1,495	378	84	21	4	1	2	..	1	245,811
							Percentages.												
Association	0·08	2·85	12·03	20·33	23·70	19·71	12·29	5·95	2·12	0·67	0·20	0·04	0·02	*	*	..	..	..	39,722
Group ..	0·23	2·61	8·73	18·45	24·86	22·21	13·75	6·22	2·15	0·60	0·14	0·03	0·01	*	..	*	..	*	206,089
Both ..	0·20	2·65	9·26	18·76	24·67	21·81	13·52	6·17	2·15	0·61	0·15	0·03	0·01	*	*	*	..	*	245,811
1929–30.							*Numbers.*												
Association	24	841	3,526	6,378	7,993	7,280	5,300	2,634	1,149	343	106	20	10	..	..	..	..	..	35,613
Group ..	697	5,485	17,811	37,749	54,712	54,056	37,587	18,883	7,088	2,108	584	134	38	6	2	..	..	1	236,941
Both ..	721	6,326	21,337	44,127	62,705	61,345	42,887	21,517	8,237	2,451	690	154	48	6	2	..	..	1	272,554
							Percentages.												
Association	0·07	2·36	9·90	17·91	22·44	20·47	14·88	7·40	3·23	0·96	0·30	0·06	0·02	..	..	..	..	..	35,613
Group ..	0·29	2·31	7·52	15·93	23·09	22·81	15·86	7·97	2·99	0·89	0·25	0·06	0·02	*	*	..	..	*	236,941
Both ..	0·26	2·32	7·83	16·19	23·01	22·51	15·73	7·89	3·02	0·90	0·25	0·06	0·02	*	*	..	..	*	272,554

* Data occurring, but relatively insignificant.

Table 10 has been compiled for the purpose of illustrating the difference in distribution of records for the Group and Association systems. As would be expected from the gradual advance in average production, each year shows a higher percentage of the total records in those classes which include performances of from 200 to 350 lb. butterfat. One must naturally look for slight out-of-step fluctuations in those classes which are more sparsely represented, and a table which covers only two seasons allows little scope for comment. Were it possible to include the past five or preferably ten years the position would be more clearly demonstrated.

Table 11 is similar to Table 10, except that it is compiled on the 210-day basis, and includes only cows tested under the Association system. Herd averages as well as individual cow averages have been taken into consideration. The remarks on Table 10 also apply to Table 11.

Table 11.—Percentage Distribution of Records and Herd Averages in Organizations controlled by Dairy Division, Season 1929–30.

Basis	Class Limits (in Pounds of Butterfat)														Total Number classified.
	Under 50	50–100	100–150	150–200	200–250	250–300	300–350	350–400	400–450	450–500	500–550	550–600	600–650	650–700	
						Records.									Cows.
100 days and over	0·04	1·30	4·56	11·42	20·39	22·90	19·99	12·03	5·13	1·50	0·57	0·14	0·02	..	4,388
210 days and over	..	..	0·90	6·42	19·13	25·55	24·05	14·80	6·36	1·87	0·71	0·17	0·03	..	3,534
						Herd Averages.									Herds.
100 days and over	..	0·39	4·67	11·28	19·07	28·40	22·57	11·67	1·55	0·39	..	.	.	.	257
210 days and over	.	..	..	1·41	14·55	36·15	27·23	17·84	2·31	0·47	..	..		..	213

Fig. 2 is based on the data supplied by Table 10, and should be studied in conjunction with that table. The figure indicates graphically the percentage frequency of records appearing in the various classes as marked along its base. By "percentage frequency of records" is meant the percentage of the total number of records represented by the number of records which fall within the limits of production within each butterfat-production class specified along the base line of the graph. The two seasons 1925–26 and 1929–30 are represented. The advancement of the modal point—that is to say, the moving-forward toward the higher-production class—is readily apparent, and demonstrates quite clearly the diminishing proportion of lower-producing individuals. The graph has not been continued beyond the 550–600 lb. butterfat division, as from that point onward the percentages are too small to have any important bearing on the general position.

CALF-MARKING.

An adjunct of herd-testing which is receiving considerable support in some districts is the scheme commonly known as calf-marking. Under this scheme heifer calves from registered purebred sires are

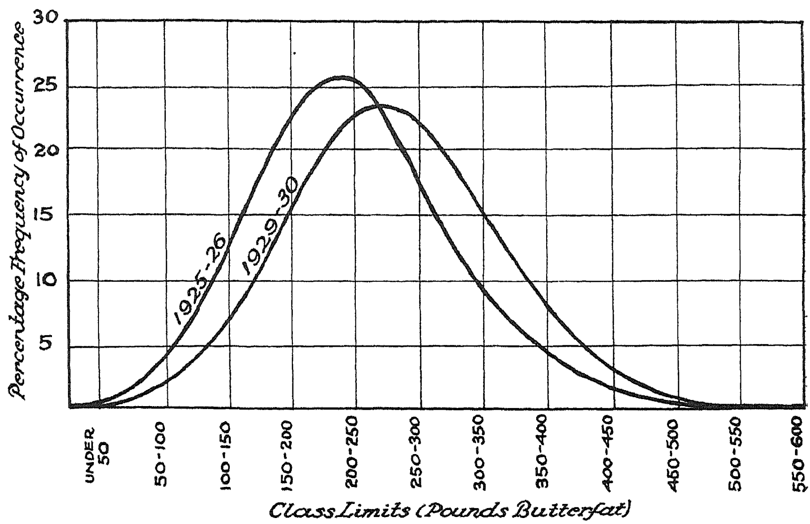

FIG. 2. PERCENTAGE FREQUENCY DISTRIBUTION OF RECORDS FOR ALL TESTED COWS REPRESENTED IN EFFECTIVE ANNUAL SUMMARIES RECEIVED FOR SEASONS 1925–26 AND 1929-30. (BASIS: IN MILK 100 DAYS AND OVER.)

marked by means of an individual and permanent identification tattoo in the ear, it being necessary for the dam to have produced under Group test a certain minimum butterfat requirement according to age. Calf-marking was first linked up with herd-testing by the New Zealand Co-operative Herd-testing Association (Inc.) some five years ago, and the system has extended rapidly. Some 641 calves were marked in the first season while last year's number was over 12,000

Two years ago the Dominion Group Herd-testing Federation (Inc.), which now controls the calf-marking work, extended the system to bull calves. With bull calves both sire and dam must be registered purebred animals, and, in addition, the dam must have been tested by an association affiliated with the Dominion Group Herd-testing Federation. Minimum butterfat requirements according to age apply as in the case of the heifer calves, the standards being slightly higher for the marking of bull calves.

CONCLUSION.

Taking a final glance at the herd-testing movement in New Zealand as it stands at the close of the 1929–30 dairying year, it is apparent that the workers in this branch of activity have reason to be proud of the position. The foundation is well laid for considerable extension, and it would seem that we are justified in expecting still higher figures by way of yield and number of tested cows for some years to come.

The sum of £10,500 has recently been paid over by the Government as a subsidy on the past season's herd-testing, the major portion of

this amount having been distributed among testing dairy-herd owners. A sum of £8,000 has been granted by way of assistance to herd-testing carried out during the current season, 1930–31.

Apart from providing owners with data relating to the productive ability of their cows, herd-testing is playing an important part from the educational point of view, and in this direction calf-marking is doing its share. There is doubtless more attention paid each year to the matters of pedigree, herd-building, mating, and culling, and this sphere of the dairy-farmer's business cannot be conducted with the maximum of efficiency without the completeness of knowledge provided by an unbroken chain of butterfat records. The educational side is one in which there is scope for extension, and it could profitably be given closer attention in future.

A noticeable feature of herd-testing in New Zealand is its comparatively reasonable cost. This is very important. Herd-testing is only one of the avenues through which the dairy-farmer is required to expend money, and it is only one factor in successful dairy-farming. Care must be taken not to overstress the relative importance of the subject. Herd-testing will not in itself improve the herd, but it supplies that information which is essential for systematic herd-improvement.

COST OF MOLE DRAINAGE.

SEVERAL inquiries have been received from farmers regarding the cost of mole drainage. Reliable local data are supplied by Mr. W. J. McCulloch, Fields Superintendent, Department of Agriculture, who kept cost accounts respecting the drainage a year or two ago of an area of 35 acres on the Massey Agricultural College farm, when he was acting as farm-manager to that institution. The haulage was done by a tractor, and the costs were computed as follows :—

	£	s.	d.
Driving and other labour—50 hours at 1s. 10½d. per hour	4	13	9
Benzine—54 gallons at 1s. 6¼d. per gallon	4	17	4
Oil	1	4	0
Interest repairs, and depreciation on a £400 tractor at 2s. 6d. per hour	6	5	0
Total	£17	0	1

On the basis of these figures the cost of the drainage works out at 9s. 8¾d. per acre.

It should be mentioned that in this job the drains were drawn 6 ft. apart instead of the usual 9 ft. spacing, so that the work done was 50 per cent. more than in the mole drainage ordinarily carried out.

Compensation paid for Stock and Meat condemned.—Compensation to the amount of £18,183 0s. 6d. was paid out during the official year 1929–30 for animals condemned in the field for disease under the provisions of the Stock Act; and £13,383 19s. 6d. for carcasses or parts of carcasses condemned for disease on examination at the time of slaughter at abattoirs, meat-export slaughterhouses, &c., under the provisions of the Slaughtering and Inspection Act.

WINTER FEEDING OF STORE PIGS.

CO-OPERATIVE TRIALS WITH ROOTS AND MEAT-MEAL.

K. W. GORRINGE, Instructor in Swine Husbandry, Live-stock Division.

IT is often remarked in connection with pig-raising that the sow is the main factor on which depends success or failure. This statement is correct up to a certain point, but it must be recognized that the breeder assumes part control from the time the piglets are three weeks of age up to weaning-time, and from then on takes over sole control of the weaners until they arrive at the pork or bacon stages. Many farmers realize the importance of having well-bred animals in the parent stock, and with judgment in feeding and management secure two litters per year of strong, healthy pigs. The spring litter has always been considered the easier and more profitable of the two, for with a plentiful supply of skim milk and whey, together with rich spring pasture, supplemented with meal or grain, good porkers or baconers can be readily produced. It is the autumn litter which has generally been a source of worry and disappointment, in view of the fact that the litters have to go through a winter store period with its harder conditions and cost.

A quite common method of winter feeding adopted is to give roots of some kind frequently without any supplement in the form of meals or grain, with the result that large numbers of the pigs die before the spring arrives, while those which survive are usually of such a stunted and unthrifty nature that extra time, labour, and food are entailed before they arrive at the porker or bacon weights, resulting in an unprofitable finish.

As referred to in some preliminary notes published in last month's *Journal*, the advent of meat-meal as a stock-food has now greatly changed the outlook in pig-raising, especially as regards winter feeding. Following on an experiment at Lincoln College with mangels and meat-meal, the Department of Agriculture decided to institute a number of feeding trials on farms with meat-meal and any root crop that the farmer had at his command. During the past winter these trials have been conducted on fifteen farms, the owners carrying out the instructions of the Department and the Department in turn providing a portion of the meat-meal and performing the necessary weighing and supervision. The trials commenced at the beginning of June and ended about the middle of August.

The conditions under which the farmers co-operated were as follows: (1) The feeding to continue for seventy-five days, and the pigs to be weighed at the end of fifty days and at the completion of the trial; (2) from ten to twenty pigs to be supplied; (3) provision of a suitable separate paddock, a clean warm house (but nothing elaborate), with fresh water and as many roots as the pigs could consume daily, together with ½ lb. meat-meal per pig per day, to be fed dry in an open shallow trough. These directions were quite simple and capable of being carried out by any farmer. All pigs were out

in the open during the day and in every sort of weather, which at times was severe. Eleven lots were fed mangels, five with swedes, and one with chou moellier.

At the first weighing—after fifty days—a remarkable change was shown in the pigs generally. With increased vigour, bright clean skins and shiny coats, and well-rounded bodies, they closely resembled animals that had been stied and well fed. From observation, the Berkshire-Tamworth cross pigs appeared to be thriving better than the other types, except in one case where Berkshires did very well, considering they were the youngest pigs in the test.

The following table gives particulars of the trials :—

Table 1.—Co-operative Trials on Winter Feeding of Pigs.

Owner.	Number of Pigs	Breed.	Roots	Average Weight at Commencement of Test	Average Weight after Seventy-five Days	Total Increase per Pig.	Increase per Day.
				lb.	lb.	lb.	lb.
E. Nicholson, Hawera ..	8	Tamworth Cross	Mangels .	47·0	107·1	60·1	0·80
J. C. Gardner, Levin ..	9	Tamworth Cross	Mangels ..	68·3	125·2	56·9	0·76
A. Saville, Tamahere	20	Tamworth Cross	Mangels .	45·1	100·7	55·3	0·74
D. Kernohan, Koputoroa* .	20	Tamworth Cross, Large Black Cross, Large White Cross	Mangels ..	63·1	106·9	43·8	0·58
F. Smith, New Plymouth ..	10	Tamworth Cross	Swedes .	61·0	103·4	42·4	0·56
C. Zabell, Carterton .	10	Berkshire	Swedes ..	26·7	68·3	41·6	0·55
W. J. Willis, Manakau ..	10	Tamworth Cross	Mangels	31·1	70·5	39·4	0·52
A. A. Dick, Blenheim ..	14	Berkshire, Large Black Cross	Mangels ..	27·8	66·1	38·3	0·51
Hikurangi College, Carterton	21	Tamworth Cross and Tamworth	Swedes ..	42·0	78·4	36·4	0·48
F. W. Parker, Blenheim ..	10	Berkshire and Middle White	Mangels ..	60·0	94·1	34·1	0·45
F. Smith, New Plymouth ..	10	Tamworth Cross	Chou moellier	61·1	92·4	31·3	0·42
A. Langkilde, Otorohanga†	20	Tamworth Cross	Mangels ..	59·8	86·6	26·8	0·35
E. Nickolson, Hawera ..	20	Berkshire ..	Mangels ..	28·0	54·5	26·5	0·35
J. Nunn, Carterton ..	16	Berkshire ..	Swedes ..	45·1	69·4	24·3	0·33
Stoddart Bros., Manaia* ..	20	Tamworth Cross and Large White Cross	Mangels ..	48·4	72·4	24·0	0·32
A. H. Elkins, Carterton ..	22	Large White Cross	Swedes and soft turnips	36·2	58·3	22·1	0·30

* One pig died. † Two pigs died.

In addition, there was one other trial, on the farm of Mr. R. Oppenshaw, Lepperton, that was carried on only for fifty days, during which the average daily gain was 0·55 lb.

The original experiment conducted at Lincoln College, calculated on the same basis as the Department's co-operative trials, works out as follows, the roots used being mangels: Average individual weight, 66·4 lb.; average weight after seventy-five days, 104·7 lb.; total increase per pig, 38·3 lb.; increase per day, 0·51 lb.

Notes on the Results.

Average Gains.—As was to be expected, there was a considerable range in the average gains, varying from 0·8 lb. per day down to 0·3 lb., giving an average of 0·5 lb. These results can be viewed as highly satisfactory, and even in the cases where comparatively small gains have been recorded the farmers concerned are fully satisfied that with quite moderate feeding of meat-meal the carrying-through of pigs on roots is a decided success.

Mortality.—Up to the present time a feature in the wintering of young pigs on roots alone has been the high death-rate that usually occurs. All the farmers co-operating in these trials complained about their previous winter losses, and the low death-rate among the 260-odd pigs under trial—amounting to 1·9 per cent.—is of very special significance Even in those cases where the lowest increases in weight were recorded the animals came through the winter with bright clean skins and shiny coats.

Quantity of Roots consumed.—It was not found possible to get an exact record of the quantities of roots consumed, nor is this of really very great importance. Experience has amply shown that young pigs when wintered on roots alone suffer a very high mortality and on the average do very badly. The definite object of these trials was to prove whether or not small quantities of meat-meal under ordinary farming practice would make root-feeding effective and profitable.

It is estimated that the quantity of mangels consumed per day per pig varied from 6 lb. to 16 lb., the higher weights consuming somewhere about the latter figure. This is in very close agreement with figures supplied by Mr. W. J. Scott regarding the original experiment at Lincoln College, in which pigs of an initial weight of 66·4 lb. consumed 15 lb. of mangels per day over the sixty-three-day period the trial lasted.

In the ten trials recorded in the table where mangels were fed the average daily increase in weight of the pigs was 0·54 lb. Estimating that on the average of 12 lb. of mangels per day were consumed, on these figures 1 ton of mangels and 93 lb. of meat-meal will produce 100 lb. of live-weight increase. With pork at 6d. per pound, 1 lb. live-weight would be worth 4d., and deducting the cost of the meat-meal at 1¼d. per pound there would be a return of £1 3s. 6d. for each ton of mangels consumed. Put in another way, the result of these trials indicates that 1 lb. of meat-meal fed in conjunction with mangels will produce on the average not less than 1 lb. live-weight increase, or a gross return of very nearly 4s. for every shilling spent on meat-meal.

In the case of the five trials where swedes were fed, the average increase was less than with mangels, being 0·44 lb. per day as against 0·54 lb. per day. This was probably due very largely to the fact that in three cases the supply of swedes was inadequate. In the two other trials, where there was an abundance of swedes, a daily gain of 0·55 lb. was recorded. On the small dairy-farm, however, mangels are naturally the main root-crop that may be available for the wintering of pigs, and the question whether swedes or mangels are preferable will not in general come into consideration.

General.—Some of the tests proved specially interesting—for example, that on the farm of Mr. A. A. Dick, Blenheim. Although breeding his own pigs, Mr. Dick did not have any fit for the testing, as they had all been sold before the winter on account of previous unsatisfactory wintering and high mortality experienced. He therefore purchased two litters at a sale from different owners. Taking the eight best weights at the start, which ranged from 28 lb. to 32 lb., and the six lowest weights, ranging from 25 lb. to 27 lb., the former lot produced an average increase of 47 lb. in seventy-five days, whereas the latter only produced $27\frac{1}{2}$ lb. From the commencement the latter pigs did not show as much vigour as the former, and probably were subject to worm trouble, which in itself would be sufficient to influence the lower production. Owing to the tender age of these pigs the full ration of meat-meal was not fed to begin with, one-third only being used and two-thirds for the finish.

Mr. R. Oppenshaw, Lepperton, purchased a very mixed line of stores, some in very poor condition. At the end of fifty days' feeding a remarkable change had taken place in the pigs, most of which were then fit for pork, and so good were they that the owner asked to be excused from feeding any longer in the test, as he wished to kill some at once for pork. He was a butcher by trade and recognized their good condition. One pig increased 58 lb. in fifty days.

A comparison trial between swedes and chou moellier conducted by Mr. F. Smith, of New Plymouth, is worth noting. In separate paddocks ten pigs weighing a total of 610 lb. were fed with swedes, and ten others weighing 611 lb. with chou moellier. Those fed on swedes put on 42 lb. each, and those on chou moellier 31 lb. The difference here, as also in the case of Mr. Nicholson's two lots, may have been due more to the type of pig than to the feed.

The fact that some pigs showed small returns in the final weighing was due to a shortage of roots. This is especially noticeable in the case of Hikurangi College, which put up a good performance of 27·4 lb. in the weighings for the first fifty days and then dropped to 9·5 lb. in the last twenty-five days.

It is needless to comment on the remainder of the trials, as the figures show that they were highly satisfactory. Individual farmers have expressed their thanks to the Department for giving them the opportunity to carry out these tests in such a simple manner, and are highly pleased with the results obtained. In the case of two or three farmers it was the factor in deciding whether or not they would in future carry their pigs through the winter, and it is pleasing to note that they have all now agreed, in view of the good margin of profit shown over their winter operations and the excellent beginning under spring conditions, to carry on their pigs to heavier pork or bacon weights.

Owing to the wide area over which the tests were conducted it was not possible for the writer to personally obtain all the data, and he desires to express his thanks to Messrs. J. G. Scott, B. Grant, H. E. Allen, J. D. Anderson, H. R. Denize, F. W. Sutton, T. L. Morris, and W. G. Bonner, Stock Inspectors in the various districts, who assisted in the weighings.

FEEDING ENSILAGE TO SHEEP.

FARMERS' EXPERIENCES IN PAST WINTER.

Fields Division

ON many sheep-farms, because of economic considerations, total carrying-capacity is limited by winter carrying-capacity. Practically, the minimum carrying-capacity tends to become also the maximum carrying-capacity. This is because it does not prove financially attractive to purchase extra stock when winter is over, even though there is on hand sufficient feed to meet adequately the needs of such extra stock. If such stock were purchased in the spring they would be bought on a strong market, and a corresponding sale would be necessary in the following autumn on a usually weak market. Buying on a strong and selling on a weak market seldom proves satisfactory. Hence sheep-farmers should welcome any practice that would enable them to so increase their stocking as to be able to better use the spring and summer growth without being obliged to sell off regularly on a weak autumn market. Ensilage is a practice which promises to do this under many conditions.

While the use of ensilage in this connection is of interest to sheep-farmers generally, it is of special interest to many of those who are contemplating an extension of their grassland top-dressing programme. It has been laid down, as the result of experience both in New Zealand and overseas, that the best accompaniment of top-dressing is close grazing. From this it follows that if top-dressing is carried out and the resultant extra growth is not fully utilized, then the greatest possible financial returns from it are not being realized. Suitable ensilage measures provide a surety that top-dressing and desirably close grazing may be made to accompany each other, whereas top-dressing without ensilage may bring about uncontrolled summer growth of pastures—a position unwelcome not only as regards the welfare of the pasture, but also as regards the nutrition of sheep and especially of lambs.

Under many circumstances the date at which top-dressing is carried out will materially affect the amount of ensilage necessary. Usually top-dressing done in the late summer or autumn (as against winter or early spring) will result in increased winter and early spring grass-growth, and so less silage will be required to tide the flock over this critical period.

With a fuller appreciation of the value of grass utilization by sheep-farmers the question of carrying sufficient stock during the period of shortage becomes a very important factor in farm-management. In some cases the necessary provision is made by growing root-crops and the saving of hay—both very important where conditions are suitable—but on most farms with sufficient level land to enable the mower to be used there is no doubt that as its value becomes better known ensilage will be the main factor in the provision of this extra fodder.

Experiences from various Districts.

In the *Journal* for April last the experiences of several farmers in the feeding of silage to sheep were given. Since then, the experiences

of a number of others during the past winter have been gathered by officers of the Department, and are now related, as follows :—

WAIKATO.

Whewell Bros., Matangi.—This farm is 400 acres and was carrying dry dairy-stock and sheep—chiefly breeding-ewes for fat lambs. Messrs. Whewell Bros. fed silage to 600 aged ewes. These sheep were confined to 45 acres of pasture, the feed on which was almost negligible. Some hay was fed out, but ensilage was mainly depended upon. The ewes were carried through lambing-time till 1st September, when they were changed to a fresh clean paddock and the silage discontinued after seven weeks. This mob took about eight days getting accustomed to the supplementary feed. The ensilage was more suited for cattle, but the ewes held their condition very well, and lambed satisfactorily with a good supply of milk No scouring occurred, and only one ewe had bearing-down trouble. The ensilage used was cut from a 10-acre paddock. Messrs. Whewell Bros. are very well satisfied with the experiment. They intend to make more suitable ensilage for sheep next season, and to increase their next winter carrying-capacity considerably.

W. B. Walker, Kihikihi.—The mob of sheep on this property consisted of 500 breeding-ewes—two-tooth to full mouth. These sheep were held on 25 acres and fed with ensilage for nine weeks, till 14th August, when they were given a change and the silage discontinued. The ewes were entirely dependent on the supplementary feed. As in the case of Messrs. Whewell, the sheep were in good store condition to commence with, and this was maintained without the least set-back. In this instance the ewes were about eight days before getting accustomed to the new forage. Over 100 per cent. of sturdy lambs have been docked, so that the feeding of silage has been a decided success. No bearing-down trouble was experienced, and only two deaths occurred. The silage stack from which the sheep were fed was two years old, and, although good, it was not of a kind ideal for sheep. About 500 acres of Mr. Walker's farm are in grass, and on this, with the addition of silage, he wintered 1,850 ewes, 250 hoggets, 40 rams, 150 cattle, and 20 horses. The silage from 14 acres enabled the carrying of 400 extra ewes. Next winter the carrying-capacity will be increased by five or six hundred sheep. It may be mentioned that the horses were also fed on ensilage and kept their condition.

E. C. Houchen, Ohaupo Road.—On Mr. Houchen's farm silage was fed to 450 aged ewes in rather low condition. They were allowed the run of 30 acres, subdivided into three paddocks. Ensilage was fed to them, generally twice daily, with about three feeds of hay weekly. The feeding of silage commenced on 12th June and continued till 31st July. During this period it is estimated that the ewes consumed 48 tons of ensilage, or the product of 8 acres. As in the two previous cases, the silage was much more suitable for cattle than sheep. Owing to the condition of the ewes this experiment has been a very severe test, and yet the lambs are well nourished and doing well. In this case twelve deaths of ewes occurred. The extra carrying-capacity in the past winter is estimated at 300. Next winter, with more suitable ensilage, it is intended to double the number. Next year Mr. Houchen purposes varying his methods of feeding somewhat by giving the sheep more change of pasture. Ensilage will not be given until the pasture is eaten out after each change.

I. R. K., Korokonui.—In this case ewes were being fed on turnips. Ensilage was also being carted out to cattle in an adjoining paddock. I. R. K. noticed that his neighbour was feeding out ensilage to his ewes

and decided to try it with his own as a matter of curiosity. To his astonishment the ewes immediately left the turnips and took to eating the silage without hesitation.

TARANAKI.

H. Barr, Scott Road, Hawera.—The number of sheep fed with ensilage was 1,100, commencing the first week in May. It was found that there was no difficulty in inducing the sheep to take the ensilage at the start. None of the sheep had been previously fed on ensilage, but were used to being fed on forage crops. The ensilage was from a stack made from lucerne and Western Wolths rye-grass. The colour was good, being of light brown in most of the stack; the top portion was a little dark due to overheating; and the last 6 in. at the bottom was greenish and slightly sour. The last two types—the overheated and the slightly sour—the sheep did not like so well as the light-brown sweet material. It was found, on the other hand, that the cows would take the slightly sour material in preference

FIG. 1. SHEEP KEEN FOR ENSILAGE ON A TARANAKI FARM.

to the other. There was no salt used in the making. The amount fed was judged by what the sheep would eat. If any was left over then the next day's amount was reduced. The ewes were about five years old. The ewes would line up along the fence every morning waiting for the cart to come over from the stack, and they would follow it round while the ensilage was being spread.

S. Topless, Urenui, and A. Turnbull, Huirangi.—Both these farmers consider the feeding of silage to sheep has been very successful, and have fed in-lamb ewes continuously from June to September. Each year some little difficulty is experienced in inducing young sheep to commence eating silage, but once they have started eating it no further trouble is experienced. The method of starting is to hold the sheep in a small paddock for a day or two until they are hungry and then feed ensilage to them. Mr. Turnbull considers that his ewes show a great preference for and do much better on silage made from grass cut in the young stage.

HAWKE'S BAY.

Rosslyn H. Tod, Otane.—Mr. Tod writes as follows: "I have been feeding ensilage to sheep in winter for four years, with satisfactory results. The carrying-capacity of a farm can be increased by about 20 to 40 per cent. in a flock of, say, 2,000, where a stand of lucerne is used and converted into ensilage. In a normal season grown sheep thrive when ensilage is fed to help out the pasture in winter after they have acquired the taste for it. Ensilage for sheep must be of good quality—cattle are not so particular about quality, and eat anything. Hoggets are much more fastidious than grown sheep, and discriminate at once between the sweet-smelling brown ensilage and the green sour-smelling stuff—they prefer the latter. Hoggets take longer to acquire the taste, and therefore suffer more in the learning if the pasture is poor. If ensilage-feeding is adopted as part of a farming system it is a good idea to train the hoggets to eat a little, as it saves trouble and waste if in later years they come under the system of an ensilage ration. I fed ensilage to ewes in lamb this year. They had never known artificial feed of any description before, and as the pasture was rather poor on account of the drought, which extended right into the winter in Hawke's Bay this year, they suffered considerably in condition before acquiring the taste. They did better later and cleaned up all that was given to them, but will not get back the condition they lost and are still showing the effects at lambing (the critical time). There were 640 in this mob of ewes—their ages ranging from two-tooth to eight-tooth—and the ration was approximately 5 lb. per head per day. In my experience ensilage for sheep is a success. I would not say that it compares with a crop of roots, but it is easier won. It feeds well with roots. All this ensilage was made out of lucerne."

C. Rosser, Pakipaki.—Area of farm, 271 acres. Good-quality land, all on flat. Of supplementary crops in the past winter, Mr. Rosser had 10 acres of mangels, and 65 acres of autumn-sown young grass had not been grazed by the middle of August. The stock wintered was 1,900 hoggets, 200 breeding-ewes, about eighty dairy cows, and forty dry cattle, horses, &c. At mid-August the ensilage stacks were nearly finished. There were three stacks about 36 ft. by 18 ft. by 8 ft. high, and the ensilage was made from grass, the quality of which was quite good. The scene when Mr. Rosser was feeding one lot of hoggets was a remarkable one. The hoggets left the mangels which had been spread in the paddock, and ran from all directions to meet the motor-lorry with the ensilage. These hoggets ate the ensilage ravenously and appeared to be in fine condition. Two hundred breeding-ewes in a paddock of 4 acres, and which were lambing, looked well, and were living entirely on ensilage. It should be mentioned that the two paddocks the hoggets were in had stacks of threshed rye-grass in them, but this was not being eaten much and was probably more useful as shelter. Mr. Rosser states that it takes about ten days for sheep to take to ensilage properly, but there is no doubt they eventually become extremely fond of it. He started feeding ensilage in the beginning of May, and used it for all classes of stock.

Estate of W. Van Asch, Craigie Range, Tukituki.—On this property one paddock of 48 acres carried 1,500 four-tooth Romney-cross wethers, and a second paddock of 115 acres had 2,600 four-tooth wethers. Large quantities of very good ensilage were carted out daily to both lots of sheep, and it was a most impressive sight to see these large mobs flock round the wagon, running from all directions and pulling the ensilage off the wagon. The sheep were fed ensilage from 25th June onwards, and kept in good store condition. It should be mentioned that these 4,000 wethers were being fed for two outside owners at 3d. per head per week until sufficient spring growth of grass arrived. Mr. Van Asch, jun., calculated that he was

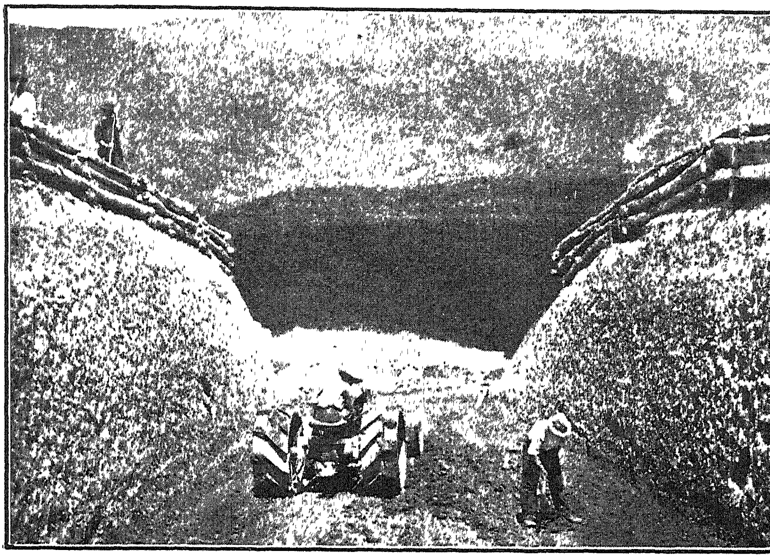

FIG. 2. MAKING CUT THROUGH A RIDGE FOR ENSILAGE TRENCH ON THE VAN ASCH ESTATE, HAWKE'S BAY.

FIG. 3. LOADING ENSILAGE FOR FEEDING OUT TO SHEEP, VAN ASCH ESTATE.

This view also shows the method used for finishing the construction of the trench.

feeding about 1 lb per head per day Here, also, it was stated that it takes eight to ten days' starving to induce sheep to acquire a taste for ensilage, and both Mr. Rosser and Mr. Van Asch suggest that it would be better to yard the sheep for three days·or so and get over the difficulty more quickly It is also agreed that sheep should be taught to eat it while they are still in good condition, and not after they have been allowed to become more or less poor. The total deaths up to mid-August among the 4,100 wethers were only six. One pit alone on Mr. Van Asch's farm is computed to contain 600 tons of ensilage. The measurements are over 90 ft. long, 25 ft. wide, and 22 ft. deep This, it is understood, took three weeks to make with a tractor and automatic scoop, team ploughing, and one man on the batters.

W. Stokes, Tikokino.—In this instance the sheep were 300 stud Romneys. They were very stubborn in commencing to take the ensilage, but became very keen indeed after acquiring the taste. In fact, they became so keen and put on condition so quickly that for a short time the ensilage had to be discontinued. On a reduced ration this stud flock has been satisfactorily carried through the past winter.

Thompson Bros., Ngatarawa.—These farmers have been feeding ensilage to sheep successfully for several years. Their farm consists of 433 acres, and its carrying-capacity is approximately 3,000 sheep. The silage, which is made of lucerne principally, is saved in pits. This year feeding extended from 16th March to 16th April, and from 3 lb. to 4 lb. per head daily was fed together with some hay. Messrs. Thompson, believing that a change of feed is advisable, provide silage in the morning and hay at night. A remarkable feature of silage feeding to ewes, according to Messrs. Thompson, is that the troubles often accompanying lambing are practically non-existent among their breeding stock.

WELLINGTON.

During 1930 the experiences on the farms of Dr. Paget, Waverley, Mr. R. Black, Karioi, and Mr. A. S. Brewster, Makino, Feilding, were on similar lines to those recorded in the April issue of the *Journal* in respect to the 1929 season.

MARLBOROUGH.

J. P. Donald, Havelock Suburban.—In this case grasses and clovers were made into ensilage in a pit in a hillside, approximately 50 tons being saved. The ensilage was fed to sheep in racks and on clippings of barberry hedge laid on the ground. The sheep went back in condition when hay was fed after the ensilage was finished.

Kennington Bros., Seddon.—On this farm the stack of ensilage, made from lucerne with a proportion of barley-grass, was of good quality. The sheep ate it readily, and one mob had very little else for six weeks, and put on condition. Cows preferred it to the best lucerne hay.

CANTERBURY.

A. Amos, Wakanui.—Mr. Amos started feeding out ensilage to sheep in June together with some turnips, and later fed ensilage alone at the rate of 2½ lb. per day. Four hundred hoggets, changed over from hay and turnips, put on quite a bloom after being on the ensilage alone for a fortnight. At the middle of September Mr. Amos was still feeding his ewes (with lambs) on ensilage, and was well satisfied with results.

E. S. Barnes, Coldstream.—Mr. Barnes fed his ensilage at the daily rate of 1¼ lb. per sheep, along with mangels. The ewes showed a decided preference for the ensilage.

OTAGO.

James Smith and Sons, Greenfield.—These farmers started feeding ensilage to 500 hoggets and 400 ewes early in June. The sheep were running in a

stubble paddock, so a square corner (about 2 acres) was fenced off and the sheep were shut in it and fed with ensilage—just a small quantity sprinkled with diluted molasses. At the end of the second day the ensilage could hardly be carted to them fast enough, so they were let out and fed in the paddock after that. They always met the dray at the gate and cleaned up all that was given them. The death-rate was very low. The ensilage gave out at the end of July, but the sheep seemed to hold their condition, and when put on young grass at the end of August they went right ahead There were not many breeding ewes in that lot, but those that had ensilage finished lambing with less trouble and loss than previously experienced. Messrs. Smith intend to try and save more ensilage this season, as they are convinced it is much healthier than turnips. Their paddocks were covered with snow for a week in the winter, but the sheep did not go back at all, as they had a good feed of ensilage twice a day

J. A. Anderson, Waiwera South.—Mr. Anderson's feeding of sheep with ensilage was made in conjunction with turnips. The sheep were put on turnips about 9 a.m., left on all day, put on a small run-off with ensilage in the evening, and left overnight. A rack made of sheep netting and staked, about 100 yards long, was used, also another feeder of sacking material supported by plain wire and staked, 8 yards in length, enabling between 700 and 800 sheep to feed at one time with comfort. Eleven hundred ewes were fed in this way, taking about 1½ lb. of ensilage per head per night, as well as as much turnips as they cared for during the day. The ewes were given ensilage for three weeks up till within a week of time due to start lambing. In the middle of September some 200 had lambed, and very little trouble had been encountered with either ewes or lambs.

Concluding Points.

By cutting surplus grass for ensilage farmers are enabled to preserve what would otherwise go to waste, and, what is also very important, they are enabled to keep their pastures short and in a very much better condition for sheep-feeding.

Another important point is that surplus grass for making ensilage, particularly for sheep, should be cut at the proper time—just when it is getting into bloom. If cut at this time the material is ideal, and the aftermath comes away rapidly. This is especially necessary for sheep-feeding, for while cattle will eat a poorer quality or an older and more stemmy ensilage, sheep do not care for it, and consequently do not do so well on it.

It may be reiterated that when there is a certain amount of grass available sheep will do well if given from 2 lb. to 3 lb. of ensilage per head per day, but where they have to depend practically on ensilage alone about 5 lb. per day should be provided.

The actual experiences of practical farmers recorded to date indicate that throughout New Zealand ensilage has been fed, in some instances for several years, to sheep of varying ages, with most satisfactory results. The recorded experiences indicate, further, that almost always there is some initial hesitation on the part of the sheep in commencing to consume the silage, but that once this hesitation has been overcome they eat it readily. This hesitation suggests the advisability of commencing the feeding of ensilage to sheep while they are still in good condition. The partial temporary starvation of sheep which are already in low condition might lead to harmful effects on the wool which would not arise from similar treatment of animals in good condition.

THE COOL STORAGE OF FRUIT.

R. SUTHERLAND, Cool Storage Officer, Horticulture Divison.

THE ORCHARDIST'S PART.

HAVING produced a first-quality product for cool storage, the fruit-grower must bear in mind during harvesting the delicate nature of the fruit, and handle it accordingly. Any injury will result in early deterioration in storage; therefore, in order to obtain the maximum results, care must be exercised during picking, transport, grading, and handling generally

When the fruit is removed from the tree it should be placed in the picking receptacle carefully. The receptacle should be firm, so that when placed in it there will not be any danger of the fruit being damaged as the picker moves about the tree. The fruit should be placed carefully in the cases and these stood on the side of the trees that will be shaded for the longest period during the day. It is of considerable advantage, when the weather is hot, for the fruit which is picked during the afternoon to be left in the orchard overnight and forwarded to the grader the next morning while it is still cool, as less injury is liable to occur when the fruit is graded while comparatively cool.

If the fruit is to be placed in a local cool store it is not necessary that it should be wrapped and packed, but only to paper-line the cases, placing the fruit in carefully and lapping the paper over the top, as it will cool rapidly when stored in this manner. The wrapping and packing can be carried out before forwarding to market, thus making sure that there is no damaged or decayed fruit in the case.

EFFICIENT STOWAGE.

The fruit should be forwarded to the cool store as soon as possible after picking, and stowed carefully in the chambers. The stacks must be uniform throughout, allowing at least ½ in. clear space round each case, and at least 12 in. between the top case and the ceiling of the chamber. This space is essential, no matter what system of temperature distribution is employed.

The cases of fruit should be stowed in such a manner that the greatest area of the case will be exposed in the direction of the air-flow, whether the cooling is by convection currents or forced-air circulation. As warm air naturally rises to the highest point in the compartment, the top cases of fruit are more likely to be exposed to a higher temperature than those lower down. By allowing free air-space over the top of the stacks, or making this position a line of least resistance, the warm air will be removed more rapidly than it would otherwise. If fruit ripens in a cool-storage chamber the top case is generally the ripest. This applies to most systems of distributing the refrigeration, with the exception of the method of delivering the refrigeration over the top of the fruit. By this system the coldest temperature is at the top, and as the cold air naturally falls more uniform temperature is maintained.

General Conditions of the Store.

As previously mentioned, very great care must be exercised in picking, packing, grading, &c. Injuries to the fruit occur that may not be visible at the time of storing, and it is possible that owing to these injuries a small proportion of fungal rots will occur, as the path of attack has been laid open for the spores of fungi which are on the fruit when it leaves the orchard. But assuming delivery to the store of fruit in good condition and free from disease or injury, the cool-storage management has also a duty to perform. The first essential is cleanliness of the establishment, both inside and outside the storage-rooms, and also around the main building. Any waste or rejected fruit must be removed immediately; empty cases, dirty papers, or accumulations of rubbish of any description should be avoided.

Uniform Temperatures during Loading.

The chambers and insulation should be thoroughly cooled before any fruit is placed in the storage-rooms. This can be more efficiently carried out when the rooms are empty, because the temperature can then be reduced to a very low degree. On the other hand, if fruit is stowed before the insulation is cooled, the process is somewhat slow, and for some considerable time it is more difficult to maintain a uniform temperature during the loading.

When loading of the rooms commences every endeavour must be made to maintain a uniform temperature suitable for the kind or variety of fruit being stored, and although this may be done it will be several days before the fruit is actually cooled. However, if during the day's loading there is a variation or rise in the temperature (which in most cases there will be) in proportion to the temperature and quantity of fruit loaded into the rooms, this variation or rise should not be greater than the refrigerating plant and equipment is capable of reducing and consolidating before the next day's loading commences.

If at the end of each week during loading the temperature of the rooms is at a uniform degree, advantage should be taken to consolidate this temperature, for, although the reading of the thermometer may show uniform temperatures, that of the fruit is very much higher. By the temperature of the fruit being consolidated during the week-end, a precaution is being taken to prevent any undue rise in the temperature of the fruit already cooled. If, however, this precaution is not taken and the refrigerating-plant is closed down, a considerable rise in temperature may take place. The result will be that when the next day's loading commences not only has this heat to be removed, but also the heat of the fruit loaded during the day. In addition, a large proportion of the commodity has still to be further reduced, and the heat generated by the fruit itself has also to be dealt with. In order to maintain uniform temperatures during the loading it is essential that the circulation of cold air be continuous over an extended period.

Ventilation and Humidity.

Adequate facilities are usually provided for ventilation cool-storage chambers. Although during loading the opening and closing of the

doors will give a certain measure of control, care must be taken to prevent the accumulation of carbonic acid or other gases evolved by the fruit.

During the loading of the fruit and its initial cooling a low relative humidity should be maintained, the regulation of which is effected by frosting and defrosting the pipes in either direct expansion or brine-pipe cooling, and by regulating the density of the calcium-chloride brine in the battery system. Defrosting the pipes dries the air, and in the battery system the moisture from the air will be absorbed by the brine. In order to absorb the moisture from the air chloride of calcium brine having a specific gravity of 1·189 (which will represent a reading of 92° by a Salometer and of 23° by Beaume) is necessary. When these readings are taken the brine must be at a temperature of 60° F., and must be either warmed up or cooled down to this temperature. It will not be long before the specific gravity of the brine decreases in proportion to the moisture absorbed, and it will be found necessary to evaporate the moisture in a concentrator. Although this high specific gravity is recommended during the initial cooling, it is not recommended that it be carried throughout the storage season, as brine of a specific gravity of 1·159 is suitable for all practical purposes.

Systems of Refrigeration.

There are in general use three principal systems of refrigerating cool stores: (1) Cold-air circulation or the battery method, (2) direct expansion, (3) brine circulation. To these may be added the dry-battery method with air circulation.

COLD-AIR CIRCULATION OR BATTERY METHOD.

The battery-room is usually erected at the end of the cool-storage building; it is constructed and insulated in a similar manner to the storage-chambers. At the bottom of this room a tank made of steel or 8 lb. sheet lead is fitted to hold the chloride of calcium brine. The battery consists of a nest of ammonia-expansion pipes. The air is drawn by a powerful fan over this battery of pipes, in which the ammonia is expanding, and over which the brine is kept flowing. The air in passing over the coils is cooled; its moisture and any impurities are absorbed by the brine. The air is then delivered into the storage-room sweet and clean.

The cooling-battery is in a separate compartment, and the temperature of the storage-room can be regulated by the opening or closing of the shutters which are fitted on the air-trunk. This being so, the battery-room and brine can be reduced to a very low temperature without the danger of it being too low in the storage-room. In this way reserve refrigeration can be stored, enabling the engineer to make preparation to receive a large consignment at any time. He can also divert a major portion of the cold air to one or more chambers, and at the same time maintain a uniform temperature in other rooms.

During the flush of the picking-season there are times when very large consignments of fruit come forward for storage, while at other times the quantities are smaller. It may often happen that the temperatures are well in hand, and if the attendant is aware that a large quantity of fruit is due the next day he is enabled by operating

on the battery to make preparation to receive the fruit and still maintain a uniform temperature during the loading of the chambers.

While the engineer is operating on the battery all the ducts can be checked, just allowing sufficient cold air to enter the chambers to remove the heat generated by the fruit and that leaking through the insulation, thereby maintaining a uniform temperature and making preparation for receiving the next day's supply. By the engineer observing the arrival of the various consignments at the works, and also the chambers in which the fruit is being stowed, and operating the shutters according to the number of cases being stowed in each compartment, the temperatures of the rooms can be maintained with only a slight variation during loading, owing to the fact that a portion of the refrigeration necessary to maintain the temperature has been stored in the battery.

DIRECT EXPANSION.

This system is by far the most simple method of cooling, and is usually installed in small stores which are operated by men without much mechanical knowledge. The coils, in which the ammonia expands, absorbs the heat, and produces the refrigerating effect, are placed on the walls of the cold rooms. As the ammonia expands in the coils the temperature of the pipes is reduced and the moisture from the air is deposited upon them in the form of snow. The snow has to be thawed off the pipes from time to time. For the purpose of taking the water away when the pipes are defrosted, gutters are fitted underneath the coils. The circulation of the cold air is set up by the air nearest the coils becoming the coldest, which continues as long as there is a difference in temperature between the air surrounding the coils and the average temperature of the room.

BRINE CIRCULATION.

In this system the ammonia is expanded in coils fitted in a tank which is utilized to cool the brine. The brine is then circulated through pipes placed in the various cool rooms.

The brine is drawn by a pump from the cooling-tank and is kept under a pressure which depends on the circumstances of the store, and may be anything from 10 lb. per square inch upwards. Under this pressure it is circulated through the coils, which are in series in the various rooms. The brine after passing through the coils is returned to the cooling-tank. As the brine is all the same temperature when it leaves the cooling-tank, it is obvious that in order to vary the temperature of any room it is only necessary to regulate the quantity of brine through the coils placed in it.

Nevertheless, great care has to be exercised in placing and installing a brine system, as in addition to the refrigerating system, the hydraulic side of the question has to receive attention.

DRY-BATTERY METHOD WITH AIR CIRCULATION.

When the battery system is discussed, the dry battery is often confused with the wet battery. In the latter the moisture is absorbed and its attendant impurities are destroyed by the cold brine, whereas in the dry battery, although the ammonia-expansion coils may be in a separate compartment, the moisture from the air accumulates on

the pipes and has to be thawed off from time to time in order to maintain refrigerating efficiency and a certain measure of control over the relative humidity of the air. Then, again, with the dry battery the air after passing through the fruit is not washed and purified, but is circulated continuously with all its attendant impurities.

Methods of distributing Refrigeration in Fruit-stores.

(1) The cold air is forced through a large trunk which is situated over the end of the storage-room. Openings are made in the bottom of this trunk and fitted with shutters for regulating the supply of cold air to the room, thereby controlling the temperatures. The suction or return trunk is situated in a similar position on the other end of the room, and through this the air, after passing over the fruit, returns to the battery. Where this system is installed it is necessary that a space 12 in. to 15 in. wide be allowed immediately underneath the delivery ducts, in order to facilitate a free delivery to the chamber, and also to minimize the danger of the fruit being frozen in this position.

(2) Similar trunking to that described under No. 1 is used, with the addition of auxiliary trunks leading from the main trunk to the centre of the chamber. These auxiliaries are fitted over the division walls, and branch T-wise, each one delivering air into the centre of two chambers. These trunks are also fitted with regulating shutters. By this method of trunking the difference in temperature between the main delivery and return air is minimized, as the length of the rooms is halved.

(3) Under this method there are also similar main trunks, with the addition of a false ceiling of slotted boards or perforations. With this system the cold air can be delivered in the chamber either through the ducts or through the false ceiling, or both together. The air, after passing over the fruit, is withdrawn through the ducts into the main trunk at one end of the chamber and returned to the battery. This system of distributing the refrigeration gives a uniform temperature throughout the storage-rooms.

(4) The cold air is delivered by trunks to a false ceiling. The air, after passing over the fruit, returns through a false floor to a main trunk, thence to the battery.

(5) This is a similar system to that of No. 4, but with a reverse air-flow—*i.e.*, from floor to ceiling—either through slotted or perforated boards. When this system of cold-air distribution is applied, it is necessary that ample dunnage be placed underneath the cases of fruit. If this precaution is not taken the cases when stowed will cover the apertures in the floor and stop the circulation.

(6) The air is forced through a large trunk over one end of the chamber. From this trunk the air is admitted through small perforated trunks which are carried round the top of the four walls inside the chamber. The air then, after passing through the fruit, returns by one large common duct in each room to the main return tunnel and battery.

These methods of distributing the refrigeration throughout the storage-rooms have proved most efficient where ample refrigeration has been available, and according to the attention paid to the necessary details.

PASTURE TOP-DRESSING IN CANTERBURY.

EXPERIMENTAL WORK BY THE FIELDS DIVISION, PERIOD 1924 TO 1930.

A. W. HUDSON, Crop Experimentalist, Plant Research Station, Palmerston North, and A. Y. MONTGOMERY, late Assistant Crop Experimentalist.

THIS report is divided into four parts as follows:—

I. Introduction.

II. Series of observational top-dressing experiments in which lime, phosphate, potash, and nitrogen were used.

- A. Experiments north of the Ashley River (Section 1 of map)
- B. Experiments lying between the Ashley and Rakaia Rivers (Section 2).
- C. Experiments lying between the Rakaia and Rangitata Rivers (Section 3).
- D. Experiments lying between the Rangitata and Waitaki Rivers (Section 4).

III. Observational top-dressing experiments on Banks Peninsula (Section 5).

IV. Top dressing experiments which were cut for hay.

Part I.—Introduction.

IMPORTANCE OF GRASSLANDS IN CANTERBURY.

Although Canterbury is the main annual-crop-growing province of New Zealand, its grasslands are of paramount importance, as is indicated by the following figures drawn from the official statistics for 1928–29: Total area occupied, 8,200,000 acres; total area cultivated, 2,800,000 acres. The 5,400,000 acres not cultivated is "run" country—mainly tussock grassland. Of the 2,800,000 acres cultivated, 2,000,000 are in sown grasses, and the remaining 800,000 are used as follows: 380,000 acres for grain and pulse crops; 320,000 acres for green feed, roots, and grass for hay and for seed; 100,000 acres for market gardens, orchards, homesteads, &c.

It is thus obvious that grasslands occupy by far the greatest area, and that much of the arable land of Canterbury is used for crops to supplement the grass at times when grassland production is lowest. Nearly half the acreage annually under the plough is used to provide winter feed for sheep or green feed for fattening lambs during the period January to March. Much of the grain-growing is incidental to economical renewal of pastures. In Canterbury, therefore, as in other parts of New Zealand, increased national wealth is intimately concerned with greater grassland production.

FACTORS IN ECONOMIC GRASSLAND PRODUCTION.

The chief factors affecting maximum economic grassland production are (1) species and strains of pasture plants, (2) utilization and management, (3) liming and manuring. It is not possible to arrange these factors in order of importance, because attention to one without consideration of the others will, generally speaking, lead to unsatisfactory results. Because of the importance of (1) and (2) in relation to manuring a few remarks concerning them will not be out of place here.

(1) SPECIES AND STRAINS.

The major grass species—rye-grass and cocksfoot—in relation to strain have been discussed by Levy and Davies in articles published in this *Journal.* Rye-grass is dealt with in the issues for July, 1929, and June and September, 1930, and cocksfoot in December, 1929.

A striking and valuable piece of information has resulted from the investigations of these workers. Out of 180 commercial lines of so-called perennial rye-grass collected from North, Middle, and South Canterbury, about 5 per cent. were found to be true perennial, and 14 per cent. were of a type which they describe as the " best false perennial," but which is decidedly inferior to true perennial. The remaining lines were " false perennial " or Italian rye-grass, which run out very rapidly even under high fertility.

Manuring a run-out pasture is never as satisfactory as manuring one containing a good proportion of the better and more persistent strains of such species as rye-grass, cocksfoot, dogstail, and white clover. The response to manure in the case of a run-out pasture is mainly from volunteer species which are principally annuals, the growth-period of which corresponds with the spring and early summer period of maximum production. These annuals fail to give much benefit in the low-production periods during the late summer to early spring The increased production during early summer, without an appreciable benefit in the low-production periods, merely adds to the difficulties of utilization and management.

(2) UTILIZATION AND MANAGEMENT.

More attention to rotational grazing and the saving of surplus summer grass in the form of silage and hay could be made a profitable feature of grassland farming in Canterbury. Very little hay is saved except on dairy-farms, and ensilage is almost unknown in Canterbury, in spite of the fact that large quantities of grass are allowed to run away to rank summer growth, which is partly eaten and partly trampled by stock during the autumn and winter months. Where the formation of the country is such that silage-making or haymaking machinery can be used this wasteful neglect is not justified. Further, the full benefits from manuring cannot be obtained unless the whole of the increased growth resulting is consumed when in a reasonably nutritious and digestible stage.

Trials conducted at the Canterbury Agricultural College, Lincoln, have demonstrated the possibilities for the province in increased carrying-capacity as a result of intensive utilization. (See article, " Pasture Management: Intensive Grazing for Canterbury Conditions," by M. J. Scott and D. J. Sidey, in this *Journal,* March, 1929.)

(3) LIMING AND MANURING.

Up to the present manuring with phosphatic fertilizers has been the most important single factor in the improvement of New Zealand pastures. It cannot be said that liming has been adopted seriously except in Southland, where the demand for lime has enabled it to be sold at the reasonable figure of 11s. to 12s. per ton. Canterbury has lagged behind other districts in the use of phosphate, top-dressing only 100,000 acres out of an approximate New Zealand total of 2,400,000 acres top-dressed each year.

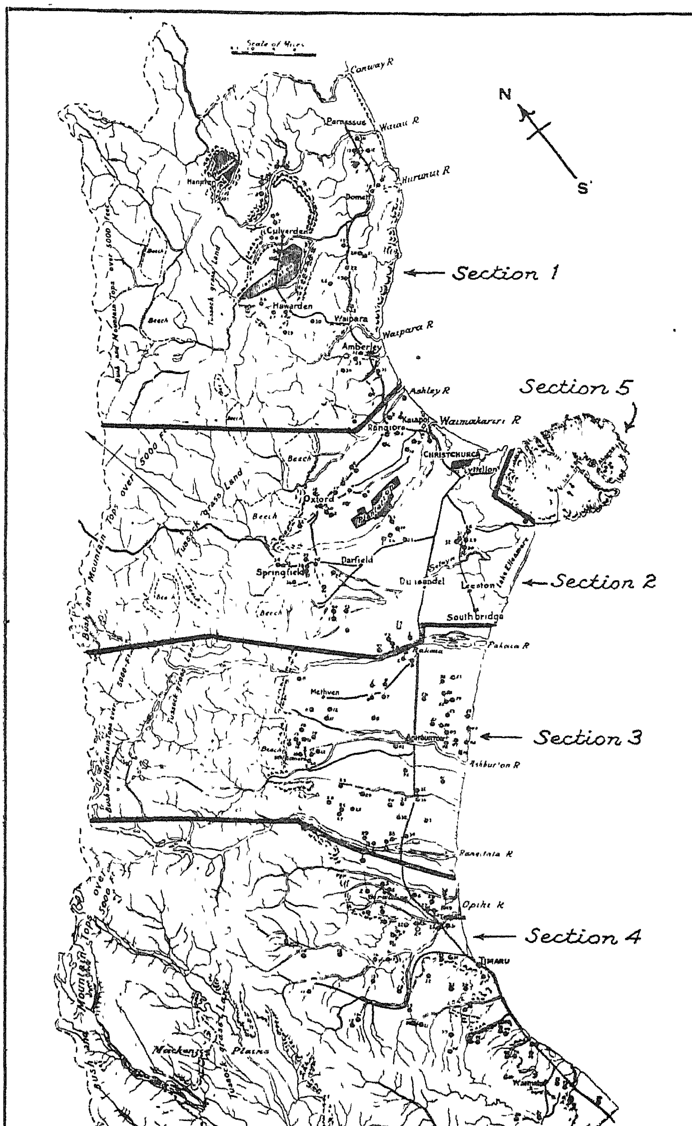

FIG. I. MAP OF CANTERBURY, SHOWING DISTRIBUTION OF TOP-DRESSING EXPERIMENTS.

Section 1, north of Ashley River; Section 2, between the Ashley and the Rakaia; Section 3, between the Rakaia and the Rangitata; Section 4, between the Rangitata and the Waitaki; Section 5, Banks Peninsula. Each experiment is indicated by a numbered dot. (The thin black lines are railways.)

Scope of the Experiments.

In order to discover the most profitable channels for the extension of pasture-manuring in Canterbury, the Fields Division of the Department of Agriculture has been actively engaged of late years in carrying out experiments of two kinds:—

(1) Top-dressing experiments, in which the yields of material cut for hay have been measured:

(2) Observational top-dressing experiments, in which the effects of manure have been merely observed, as is indicated by the name given to these experiments.

The haying experiments were commenced in 1923, and details regarding them will be given in Part IV of this report. The amount of work entailed in the carrying out of these experiments seriously limited the number which could be conducted and it was felt that information regarding manure response in Canterbury was not being obtained in a sufficiently large number of cases. Consequently a comprehensive scheme of observational top-dressing experiments was initiated in 1928. These will be discussed in Part II of this report, to follow.

The accompanying map, besides showing the distribution of the experiments, indicates generally the relationship of arable farming land (which includes most of the sown grasslands), tussock-grassland, and mountainous country. With the exception of Banks Peninsula, nearly all the experiments were laid down on ploughable land. Each section of the map will be shown on a larger scale in Parts II and III.

(To be continued.)

NAURU AND OCEAN ISLAND PHOSPHATE SUPPLIES.

Shipments of phosphate from Nauru and Ocean Islands for the year ended 30th June, 1930—the tenth year of operations under the British Phosphate Commission—totalled 504,173 tons, compared with 501,915 tons in 1927–28 and 576,590 tons in 1928–29. The cause of the decreased shipments last year was the severity of the weather experienced during the westerly monsoon season, which was considerably worse than usual, with the result that three out of the four sets of deep-sea moorings at the two islands were carried away, and re-laying them was a difficult operation.

The quantity of Nauru/Ocean phosphate imported into New Zealand in 1929–30 was 117,826 tons. The Commission also supplemented this by outside supplies, amounting to 49,983 tons, imported from Makatea Island and Morocco.

Importations for the three past years are as follows.—

	1927–28. Tons	1928–29. Tons.	1929–30 Tons
Nauru/Ocean	136,718	138,053	117,826
Morocco and Makatea ..	42,946	29,288	49,983
	179,664	167,341	167,809

The shipped output of phosphate from Nauru and Ocean Islands for 1929–30 was all absorbed by Australia and New Zealand as follows: Total, 504,173 tons; Australia, 377,073 tons (74·79 per cent.); New Zealand, 127,000 tons (25·21 per cent.). For the two preceding years the Dominion took 24·76 and 24·66 per cent. of the total respectively.

THE DIAMOND-BACK MOTH.

ITS OCCURRENCE AND CONTROL IN NEW ZEALAND.

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As far back as 1837 Curtis (1883) in his "Farm Insects" referred to the turnip diamond-back moth under the name of *Cerostoma xylostella*. Curtis stated that it was earlier referred to by Linnaeus as *Tinea xylostella* from its feeding upon honeysuckle, which bears that name. It was also known for years as *Plutella cruciferarum* Zell., but Whitehead (1894) pointed out that Curtis had previously described it in 1831 under the species name *maculipennis*. This latter terminology was subsequently confirmed by Meyrick, and the name *Plutella maculipennis* has been adopted generally for the moth. The moth was probably introduced into New Zealand from England or Australia fifty or sixty years ago, or even earlier. Kirk (1894) mentioned that this insect first came under his notice in the Wellington District in the year 1879. Meyrick (1885) recorded the presence of the moth in the Waikato, Wellington, Taranaki, Christchurch, Bealey River, and Lake Wakatipu districts. From this it will be seen that distribution was fairly general at this early date. To-day the moth is distributed throughout New Zealand, and is a serious pest of cruciferous crops in both the North and South Islands, but more especially in the latter.

The diamond-back moth is cosmopolitan in range, occurring throughout the world from Greenland to New Zealand. In common terms it is also named "cabbage moth," "cabbage web moth," "cabbage-leaf miner," and "green cabbage worm."

ECONOMIC IMPORTANCE IN NEW ZEALAND.

The total area of cruciferous crops (mostly brassicas) grown in New Zealand is upwards of 600,000 acres, of which turnips (including swedes) form the largest part, with some 475,000 acres. The greater portion of this latter area is situated in Canterbury, Otago, and Southland, the figures for the different districts in 1929–30 being Canterbury, 151,228 acres; Otago, 99,551 acres; Southland, 112,754 acres; remainder of Dominion, 111,721 acres. Rape is an important green crop, and chou moellier is extending in use.

While the depredations of the moth are general throughout New Zealand, the most serious losses are experienced in parts of Canterbury and Northern Otago. The attacks, however, vary considerably according to the locality. Inland towards the hills, for instance, the crops appear to be more vigorous, and moth attacks are not so noticeable. On the flat country towards the coast, on the other hand, and especially where the land is inclined to be light, the moth-attack may be very severe, in many cases almost completely destroying foliage, with consequent loss of the crop.

Acreage figures alone do not convey an adequate impression of the importance of these crops to New Zealand agriculture. For the fattening of lambs and for the wintering of stock they are indispensable, no

less so in every market and home vegetable garden, so that the insects and diseases which attack them are of primary importance. Aphis, as well as diamond-back moth, causes severe damage especially in the drier parts, and it is difficult to assess separately the loss caused by each

It is probable that over all the cruciferous crops grown in New Zealand diamond-back moth causes the most severe losses and most urgently calls for the devising of methods for its control.

Importance in other Countries.

Throughout the literature on the subject there are varying accounts regarding the economic importance of diamond-back moth in other parts of the world. In some countries, such as Australia, South Africa, and Argentine, its depredations are the cause of serious economic loss to cruciferous crops. In England at times it ranks as a serious pest, but only occasionally are large economic losses involved. Records show that serious outbreaks of diamond-back moth took place in the years 1837, 1851, 1888, 1891, 1901, and 1914. These outbreaks in some instances were particularly severe, and whole fields of turnips, swedes, rape, and cabbage were destroyed, cabbages generally being the most severely attacked. What holds the moths in check during the intervening years one cannot definitely say; but in all probability the main check is due to insect parasitism, the most important parasites recorded being *Angitia plutella* Viereck., *A. fenestralis* Holmgr., and *A. (Limneria) gracilis* Grav.

The reason for the periodic outbreaks has been attributed by Miss Ormerod (1901) to periodic invasions of the moth from the Continent along the east coast of England. From the literature, however, it does not appear that this insect is a pest on the Continent. Such being the case, the migration theory is hardly tenable. It is very probable, then, that the outbreaks are not due to any one circumstance, but rather that the increase is governed by an ecological complex which in the main favours an abnormal increase of the moth.

In Germany, France, and Italy this insect, as already indicated, is not present in sufficient numbers to be a serious pest, and in the last-named country it is comparatively rare. In parts of European Russia, in Siberia, and in Finland it occasionally causes considerable loss. In Canada and the United States it is sometimes serious, though Marsh (1917) quoted it as a striking example of a potentially serious pest normally held in repression by parasites, the most important being *Angitia plutella*. The incidence of the attacks of the moth in other parts of the world is very important from the point of view of its biological control in New Zealand. It is a first principle of control by this means that a parasite which fails to exercise a control in its country of origin is not likely to do so elsewhere, apart for the present from such considerations as superparasitism or hyperparasitism.

Description of the Insect.

The moth (Fig. 1) is a small slender greyish insect having a wing expanse of about 7 mm. (about $\frac{3}{8}$ in.). When at rest the wings are folded closely to the sides, the terminal edges almost touching and

having a slightly turned up appearance. The narrow creamy-yellow band bordering the dorsum and extending from the base to near the tornus is edged with black on the disk in a wavy irregular fashion. It is from the discal contour of this band that the common name "diamond-back" came to be applied. For detailed description reference may be made to Hudson (1928).

The eggs (Fig. 2) are oval and cylindrical in shape, but on the leaf they appear to have a more flattened appearance. They are light lemon-yellow in colour, have a crinkly surface, and measure less than 1 mm. in length. Before hatching the egg becomes paler in colour, and gradually the outline of the larva becomes distinguishable. It is bent nearly double, so that the dark head end just reaches the anal extremity.

The larva (Fig. 3) on hatching is a minute grub about 2 mm. in length. It is pale in colour with a dark head. The adult larvæ are variable in colour, but the majority are mainly green, a coloration which no doubt affords them a certain amount of protection from their enemies. Each measures 7 to 9 mm. in length, being widest at a distance slightly posterior to its middle, from which point it tapers posteriorly and anteriorly.

The pupa (Fig. 4) measures 7 mm. in length. When first formed it is light-green in colour, but it gradually changes to white with brownish markings. It is enclosed in a neat open net-work cocoon (fig. 9) opening at both ends, and firmly glued to the place where pupation takes place.

LIFE-HISTORY AND HABITS.

The moths are nocturnal in habit, but are readily disturbed from their hiding-places during the day. Their flight is weak and uncertain, and they soon come to rest again among the host plants. The normal life of the moth in summer months is between six and seven days. Shortly after emergence of the adults mating takes place, an act taking upwards of two hours. The number of eggs laid by a single moth varies between ninety-two and 130. The eggs are deposited in either side of the leaves of the host plant, but mostly they are to be found on the under-surface. They may be laid singly or in batches of from two to eleven. Usually oviposition takes place along the ribs or veins of the leaves, or it commonly happens that a yellowish patch on the leaf is selected.

The eggs hatch in five to six days after oviposition, and almost immediately after hatching the larvæ commence feeding by boring through the cuticle of the leaf and mining in the tissue beneath. These mines are quite conspicuous in the early stages, since they show up as numerous white markings in the leaves. From four to five days after hatching the young larva emerges from its mine to undergo its first moult. Always when about to moult the larva selects the most sheltered place available, such as a furrow on the leaf or near an edge which is slightly turned over. A few protective silken threads are then spun and moulting takes place beneath. Mining may be continued for a short time after the first moult, and then feeding commences on the under external leaf-surface. Two further moults take place before the adult larval stage is reached, the second skin being shed five days after the first, and the third skin four days later.

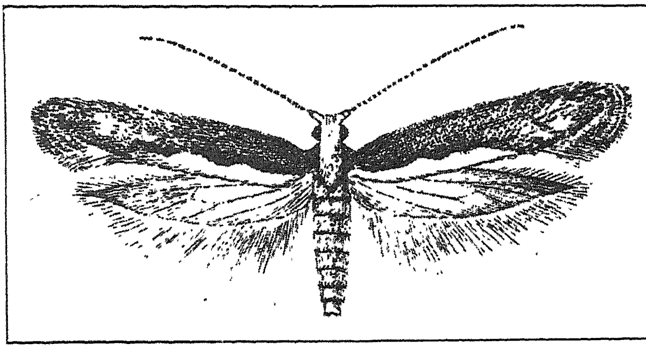

FIG. 1. DIAMOND-BACK MOTH ADULT. ENLARGED.
[After Marsh.

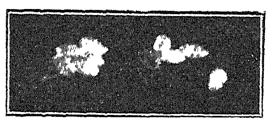

FIG. 2. EGGS OF DIAMOND-BACK MOTH ENLARGED.
[Photo by H. Drake.

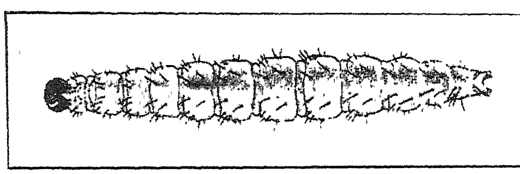

FIG. 3. LARVA OF DIAMOND-BACK MOTH. ENLARGED.
[After Marsh.

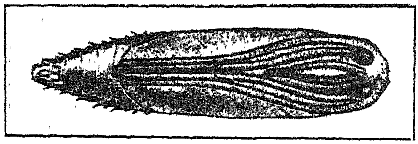

FIG. 4. PUPA OF DIAMOND-BACK MOTH. ENLARGED.
[After Marsh.

Both young and old larvæ are very sensitive to touch, and both are readily disturbed. On the approach of danger they drop from their feeding-places and remain suspended by a silken thread, by means of which they return to the leaf after all danger is apparently past. On the slightest touch they will curl into a loop or wriggle backwards in a frantic endeavour to escape Most injury is done to the plants between the time following the first moult and up to the time that

the larva constructs its cocoon. During this period the leaves are eaten out in irregular patches (Fig. 5), and very often they are completely skeletonized.

On the third day after the adult larval stage is reached the larva spins its network cocoon, in which the last larval skin is shed and the pupa is formed. Pupation usually takes place on the under-surface of

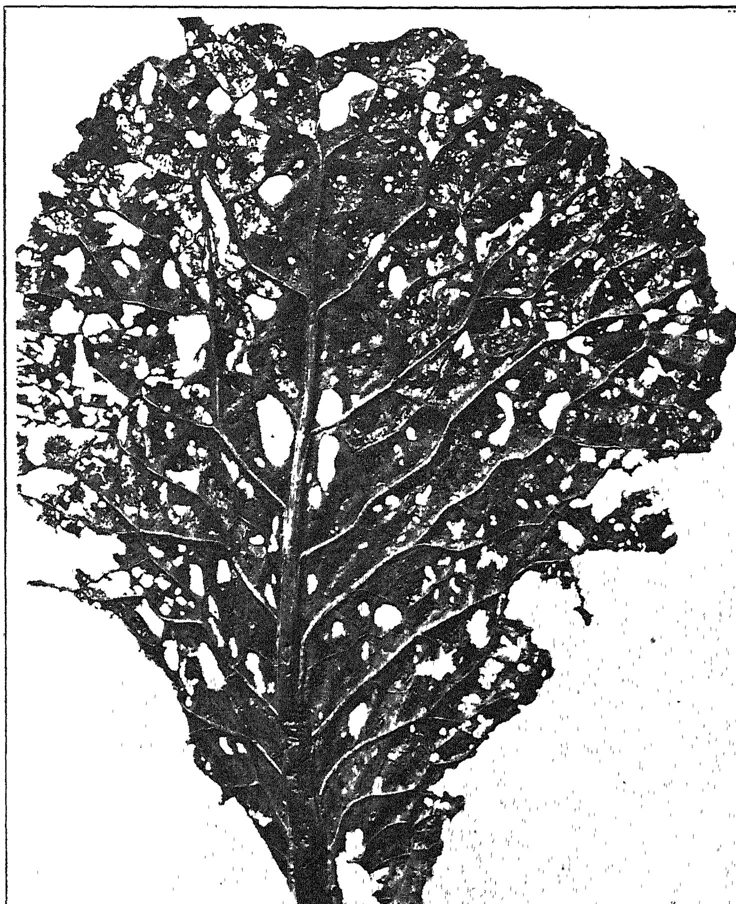

FIG. 5. CABBAGE-LEAF SHOWING TYPICAL DIAMOND-BACK MOTH INJURY.
[*Photo by H. Drake.*

the leaf, though larvæ about to pupate will readily migrate from the host to seek some nook or cranny which might afford protection. They will pupate on plants entirely different from the host, such as Scotch thistle (*Circium lanceolatum*) or sow-thistle (*Sonchus oleraceus*). Twelve days after pupation the adult moth emerges, and so the cycle commences anew.

While the life-history as above given is true for certain periods of the year, such as the February–March period, a glance at Table 1 under the heading of "Seasonal History" will show the great variation which occurs at other times of the year.

SEASONAL HISTORY.

So far as the writer's observations go, there appears to be no true hibernating period of the moth in New Zealand. It is quite possible, however, that in the colder parts of the South Island hibernation may take place in the pupal stage, as it does in some other parts of the world. All stages of the moth vary in length according to temperatures and humidities. Temperature has the greatest influence, however, since it is always with the advent of the colder weather that the different stages occupy a longer period. The following table records the individual life-cycles of the moth through the different seasons of the year as observed at this Station:—

Table 1.—Life-cycle of Diamond-back Moth at different Seasons of the Year

Eggs laid (dates)	16/2/29	20/3/29	27/7/29	27/10/29	12/12/29	5/2/30	14/3/30	22/4/30
Eggs hatched	21/2/29	26/3/29	18/8/29	5/11/29	19/12/29	10/2/30	20/3/30	4/5/30
Larvæ pupated	7/3/29	12/4/29	9/10/29	26/11/29	6/1/30	25/2/30	6/4/30	18/6/30
Adults emerge	19/3/29	24/4/29	22/10/29	7/12/29	16/1/30	7/3/30	19/4/30	14/7/30
Length of egg stage (days)	5	6	22	9	7	5	6	13
Length of larval stage	15	17	52	21	18	15	17	45
Length of pupal stage	12	12	13	11	10	10	13	26
Total length of cycle	32	35	87	41	35	30	36	84

During the period from 27th July, 1929, to 14th July, 1930—a year all but thirteen days—six generations of the moth were reared, but from an examination of the table it will be realized that seven generations are possible within this period.

HOSTS.

In New Zealand the common hosts are cabbage, cauliflower, turnip, swede, kale, and chou moellier. Cabbage is the preferred host, and during February and March the attacks on this plant are so severe as to render their growing very difficult.

In addition to the foregoing hosts Marsh (1917) recorded the following: Chinese mustard, watercress, horse radish, sweet alyssum, candytuft, and hedge mustard. Reichardt (1919), *inter alia*, also mentions wall-rocket, wallflower, wild radish, shepherd's purse, Russian thistle, and chick-pea.

DIRECT METHODS OF CONTROL.

Many sprays and dusts will control the moth, generally by coating the leaves with some poison which when ingested kills the larvæ. The usefulness of these materials is, however, limited by the fact that in its early life the larva feeds in self-made tunnels within the tissue of the leaf and so avoids any poison on the surface. This habit makes it necessary to spray or dust at fairly frequent intervals in order to catch successive broods as they emerge. Spraying is slow and tedious, since it is even more important to coat the underside of the leaves with poison than the upperside.

The expense and mechanical difficulty of spraying or dusting field crops by any method so far evolved is quite prohibitive. Gardeners who desire to preserve cherished plants from the ravages of the moth may do so by using Marsh's formula—Paris green, 1 lb.; common laundry soap, 3 lb.; water, 50 gallons. The effectiveness of this spray is dependent on thoroughness of application.

Biological Control in New Zealand.

Work on biological control was undertaken at the Plant Research Station primarily to ascertain what parasites and predators are present in New Zealand, and, if possible, to improve the degree of control biologically by the importation of further beneficial insects. The investigation, therefore, has necessitated the collection and rearing of the moth or its parasites from pupæ and adult larvæ (chiefly the latter) collected from different parts of New Zealand. From 1,768 specimens collected 1,582 moths and 120 parasites were reared, while the remainder gave no emergence and on examination proved not to be parasitized. The degree of parasitic control, therefore, is approximately 7 per cent. This percentage is far too small to be of any economic value, and is, moreover, far below that recorded in countries where other parasites occur. In England, for instance (Harper Gray, 1915), up to 89 per cent. of parasitic control has been recorded.

Up to the present only one species of parasite has been found to attack the diamond-back moth in New Zealand, and this species has been identified by the Imperial Institute of Entomology as *Angitia lateralis* Grav. (Fig. 6). The Institute states that while there is no question that it belongs to the genus *Angitia* some doubt exists as to the species, since all the authorities agree that it is extremely near to *lateralis* but certainly differing slightly.

Parasitism takes place in the larval stages, but it does not prevent the moth larva from completing its development and pupating as usual. The parasite then completes the destruction of its host, and emerges to spin its own tough and closely-woven silken cocoon (Fig. 7) within the cocoon of its host. Prior to emergence, which takes a week or more longer than would ordinarily be taken by the host, the parasite cuts a neat hole through one end of its cocoon. Just as there are numerous generations of the moth, so apparently there are corresponding generations of the parasite. One possible hyperparasite has been found, but is not yet identified.

In addition to the *Angitia* parasite attacking *Plutella maculipennis* larvæ Miller (1918) has recorded two Syrphid predators—*Syrphus novæ-zealandiae* Macq. and *Malanostoma fasciatum* Macq.—both common hover-flies well distributed in New Zealand. The *M. fasciatum* larva is light-green in colour and has a slimy slug-like appearance. The writer has frequently observed its attacks on diamond-back larvæ. It applies its mouth parts to the victim, and in twenty to thirty minutes sucks out the whole of the internal juices, leaving nothing but an empty skin. How many may be destroyed in this fashion by any one syrphid has not been estimated. Unfortunately, the good they might do is greatly curtailed owing to the presence of the parasite *Bassus laetatorius* Fabr. From the few observations made this insect gave a high percentage of parasitism. It has also been recorded as a parasite of *S. novae-zealandiae*.

Besides entomophagous insects the larvae are heavily attacked by an entomogenous fungus. In some places 60 or 70 per cent. control is afforded by this means, but, unfortunately, it comes too late in the season to be of value. The fungus is widely distributed in New Zealand, being common in both the North and South Islands. Larvæ when attacked become sluggish and turn slightly yellow before dying, shortly after which they become quite unrecognizable and finally only a flattened outline remains. This is probably the fungus referred to by Hilgendorf (1902) under the name *Entomopthora radicans* and mentioned by Cunningham (1927) as a Phycomycete. Hilgendorf was able to infect healthy *Plutella* larvæ, but not with any degree of certainty.

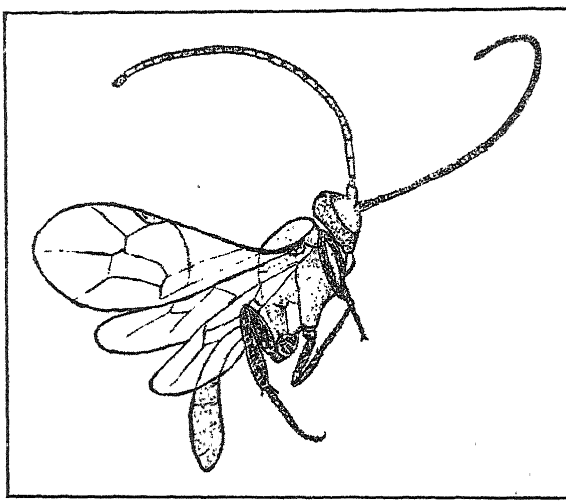

FIG. 6. ANGITIA LATERALIS, A PARASITE OF DIAMOND-BACK MOTH ALREADY PRESENT IN NEW ZEALAND. ENLARGED.

[*Original.*

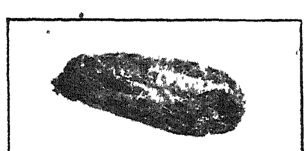

FIG. 7. COCOON OF ANGITIA LATERALIS. ENLARGED.

[*Photo by H. Drake.*

Parasites and Predators in other Countries.

The diamond-back moth has many enemies, both parasites and predators, but more especially the former. The following have been recorded from various parts of the world. A few brief notes taken from various publications are given in regard to each insect. With the object of reducing the present serious ravages of the moth larva it is proposed to introduce into New Zealand the two species first mentioned (*Angitia plutella* and *A. fenestralis*).

Angitia plutella Viereck (Fig. 8).—This insect is found in England, Europe, and the United States of America. Marsh (1917) stated it was not unusual to get from 50 to 70 per cent. of the later generations of *Plutella* larvæ infested by this parasite. Parasitism takes place in the larval stage. The host larvæ mature and spin their cocoons. "The larvæ of *A plutellae*, one from each *Plutella* larva, issue and spin compact grey cocoons within the *Plutella* cocoons." A Chalcid hyper-parasite, *Spilochalcis delira* Cresson, is recorded, but it was never sufficiently numerous to affect its host seriously.

Angitia fenestralis Holmgr.—This insect appears to be generally distributed in England and Europe and is regarded as a very efficient parasite of *Plutella maculipennis*.

Reichardt (1919) stated that this Ichneumonid parasitized all instars of the larva of the host, the degree of infestation reaching as high as 70 per cent. From this same source it is pointed out that the larva abandoned its host two to seven days after the latter had spun its cocoon in which the parasite made its own. The adult emerged in twelve to twenty-three days, according to temperature conditions.

Miles (1924) mentioned that an attack of *P. maculipennis* in Lincolnshire in 1923 was practically destroyed in the second generation by *A. fenestralis*. A hyperparasite, *Mesochorus* sp., is recorded.

According to Meier (1925) *A. fenestralis* is a parasite of various microlepidoptera, and all species of *Hyponomeuta*. It attacked the host larva in all stages and was able to breed throughout the year, though it did not completely control its host. It did not oviposit in all larvæ and some of the eggs deposited did not develop since in some cases they became surrounded by the tissues of the host and perished.

Angitia cerophaga Grav.—Voukassovitch (1927) reported that this insect was a prevalent parasite of *P. maculipennis* in the vicinity of Belgrade. *Plutella* larvæ were attacked by both fertilized and unfertilized females in the laboratory. They frequently oviposited in the young larvæ within their mines, of which they attacked several in turn. The older larvæ were not nearly so readily attacked. Parasitized larvæ completed their development and constructed their cocoons. A day or two later the parasite larvæ emerged and spun their cocoons within that of the host. The pupal stage lasted for seven or eight days at about 75° F. The male life-cycle occupied eighteen days at 71° F. An unfertilized female produced only five males.

Angitia polynesialis Cam.—Timberlake (1917) recorded this insect as being common in Hawaii and in the United States. He stated it is not unlikely that this species occurs in Europe and that an earlier name may be found for it.

Angitia (Campoplex Limneria) majalis Grav.—This insect is widely distributed in Europe and parasitizes the pupæ, only one larva being found in each host. No accounts are available regarding its effectiveness as a parasite.

Angitia (Campoplex Limneria) gracillis Grav.—Reichardt (1919) stated that *A. gracilis* infested 89 per cent. of *P. maculipennis* cocoons during the 1914 season in England. This is probably an error in the translation of Harper Gray's (1915) account. This latter author mentioned that of two hundred cocoons taken from a turnip-field

during an outbreak of the moth in 1914 only twenty-two moths emerged, while the remaining 178 were parasitized *Limneria gracilis* Grav. being one of the parasites concerned The degree of parasitism in this instance was 89 per cent., but it is unfortunate that the separate percentages for the different species concerned were not given.

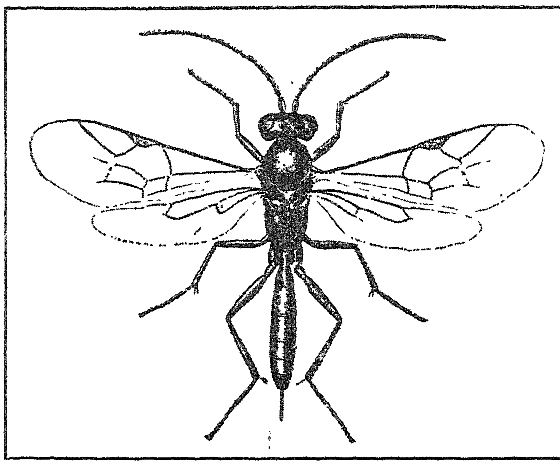

FIG. 8. ANGITIA PLUTELLA, ONE OF THE PARASITES IT IS PROPOSED TO INTRODUCE. ENLARGED.

[*After Marsh.*

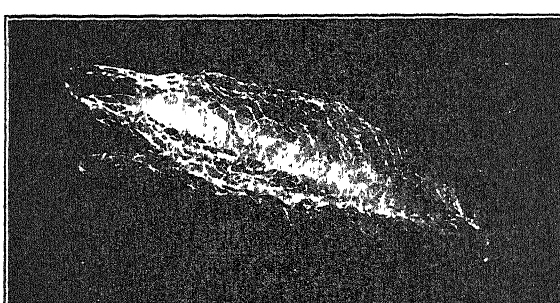

FIG. 9. COCOON OF DIAMOND-BACK MOTH WITH PUPA INSIDE.

[*Photo by H. Drake.*

Pimpla alternans Grav.—Voukassovitch (1927) stated that this insect was found in almost equal numbers in larvæ and pupæ; in the former case its cocoon was found close to the remains of the larva within the cocoon that *P. maculipennis* had constructed. The degree of parasitic control was slightly over 30 per cent.

Sagaritis latrator Grav.—In 1912 about 40 per cent. of the caterpillars in Astrakhan, Russia, were infested with this parasite.

Various other parasites have been reared from *Plutella* larvæ, but no reliable accounts are available regarding their effectiveness as controls. These are *Microplitis plutellae* (an Ichneumon) in North America; *Limnerium leontiniae* (an Ichneumon) in Argentine; *Tumidicoxella plutellophaga* (a Chalcid) in Australia; *Diadromus subtilicornis* Grav., and *Thyraeella collaris* Grav., near Belgrade, the former being a parasite of the pupa; *Tamelucha plutellae* Ashm. has been obtained from the pupæ of *P. maculipennis* in Saratov and Astrakhan, each pupa harbouring fifteen larvæ of the parasites, *Phygadeuon rusticellae* Bridgm. in England; *Apenteles plutella* Kurd. in Poltava. *Tetrastichus sokolowskii* Kurd. also occurs in Poltava, but is sometimes a hyperparasite, attacking the larvæ of *Angitia plutella*. Finally, from the United States Marsh (1917) recorded a new species of *Microplitis*, *Meteorus* sp., and *Mesochorus* sp. Regarding this last parasite it has been noted that Miles (1924) recorded a *Mesochorus* sp. in England as a hyperparasite.

Predators.—Apart from parasites above mentioned, a few predators of *P. maculipennis* have been recorded. These consist of two Coccinellid beetle larvæ (*Coccinella septempunctata* L. and *Coccinella (Propylaea), quatuordecimpunctata* L., occurring in Russia, and a large green Mantid, *Sphodromantis gastrica*, in South Africa. With regard to this last insect Gunn (1917) stated that it was frequently found in large numbers both in the nymphal and adult stages in infested fields and large numbers of *P. maculipennis* larvæ were destroyed by it. Unfortunately, however, it did not appear until too late in the season to be of any value.

Other enemies of diamond-back moth recorded are birds and fungi. Regarding the latter, it is remarked in a publication by Lind, Rostrup, and Kolpin Ravn (1914) that *Entomophthora radicans* killed the remaining *Plutella* larvæ in the latter part of the season of 1914, following a severe outbreak of the pest in Denmark.

SUMMARY.

The diamond-back moth, which is a cosmopolitan species, is a serious pest of cruciferous crops in New Zealand. There are six generations of the moth a year, and all stages are to be found throughout the different seasons. The natural enemies of the moth in New Zealand include insects and fungi, but none of these is found capable of exercising the control desired. In other parts of the world the ravages of this insect are greatly reduced owing to the presence of certain beneficial parasites. It is therefore proposed to introduce two of these parasites, *Angitia fenestralis* and *Angitia plutella*, into New Zealand in the hope that they may reduce the moth depredations in this country to uneconomic proportions. The Imperial Institute of Entomology is undertaking the despatch of these insects, and it is expected that consignments will arrive here in time for this work to be undertaken during the present season.

REFERENCES.

BRETHES, J., 1923: La Polilla del Repollo. *Ann. Soc. Rural Argentina*, Vol. 7, pp. 162–166. (11–233.)

CURTIS, J., 1883: Farm Insects, pp 85-87.

CUNNINGHAM, G. H., 1927: Natural Control of Weeds and Insects by Fungi. *N.Z. Jnl. Agr.*, Vol. 34, pp. 244–251.

FRENCH, C., 1893: Handbook of the Destructive Insects of Victoria, Pt. 2, pp. 157–163.

FROGGATT, W. W., 1910: The Diamond-backed Cabbage Moth. *Agr. Gaz., New South Wales*, pp. 894–899

FULLAWAY, D. T., 1914: Dept. Hawaii Agric. Exp. Sta., Washington, D.C., pp. 43–50. (3–363.)

GRAY, A. H., 1915. *Jnl Board of Agric.*, London. 22, No. 3, pp. 222–236. (3–550.)

GUNN, D., 1917: Union of S. Africa Dept of Agric., Pretoria, Bull No. 8. (6–248)

GURNEY, W. B, 1924: To Control Cabbage Moth. *Agric. Gaz., New South Wales*, Vol. 35, p. 325. (12–373)

HARPER GRAY, R. A., 1915: *Jnl North of England Hortic. Soc*, Leeds. Nos. 53, 54, pp 197–201. (3–745.)

HILGENDORF, F. W., 1900: Life History of *Plutella cruciferarum*. Trans. N.Z. Inst., Vol. 33, pp. 145–146.

——— 1902: Short Notes on Some Insects *Ibid.*, Vol. 35, pp. 264–267.

HUDSON, G V., 1918: The Butterflies and Moths of New Zealand, p. 331.

LIND, J, ROSTRUP, S, and KOLPIN RAVN, F., 1915: Oversogt over Landbrugsplanternes sygdomme i 1914.

——— 94 Beretning ira Statens Forsogsvirksonalid i Plantekultur, No. 31m, Kobenhavn. (3–697)

KIRK, T. W., 1894: Leaflets for Gardeners and Fruitgrowers, No 3, New Zealand Dept. Agric.

——— 1909: Diseases of Turnips, Bull. 14, New Zealand Dept. Agric.

MARSH, H. O., 1917: *Jnl. Agric Research*, Washington, D.C, Vol. 10, pp. 1–10. (5–449.)

MEYER, N F, 1915: A Few Words on the Biology of *A. fenestralis* Holmgr and on Immunity of Insects. Defense des Plantes, 11, No. 3, pp 147–250 (13–543)

——— 1926: Biologie von *A. fenestralis* Holmgr des Parasiten von *P. maculipennis* Curt, und einige Worte uber Immunitat der Insekten. *Zeitsch angew. Ent.*, 12, No. 1, pp. 139–152. (14–416)

MEYRICKE, E., 1885: Description of New Zealand Micro-Lepidoptera Trans. N.Z. Inst, Vol 18, p 177

MILES, H. W., 1914: The Diamond-back Moth, *Plutella maculipennis* Curt. Ann. Rept. Kirton Agric. Inst, 1923, pp. 45–48. (12–283.)

MILLER, D., 1918: The Economic Bearing of Hover-flies. *New Zealand Jnl. Agric.*, Wellington, pp 129–135. (7–49.)

ORMEROD, Miss W., 1892: Diamond-back Moth, *Plutella cruciferarum*, Zeller — Report of Observations of Injurious Insects and Common Farm Pests during the Year 1891, with Methods of Prevention and Remedy, pp 105–164.

QUEENSLAND JOURNAL OF AGRICULTURE, Brisbane, 1918, Vol 9, pp. 204–206

REICHARDT, A. N., 1919: The Cabbage Moth, *P. maculipennis* Curt. Bulletin of the Sub-section for the Control of Plant Pests attached to the Petrograd Committee of Rural Economy, i, pp. 6–77. (9–345.)

THEOBALD, F. V., 1926: The Diamond-back Moth (*Plutella maculipennis*). *Jl. Kent Farmers' Union*, 20, No. 3, reprint, 7 pp (14–594)

TIMBERLAKE, P. H., 1917: Notes on Some of the Immigrant Parasitic Hymenoptera of the Hawaiian Islands.—*Proc. Hawaii Entom. Soc. for the Year 1917*, Honolulu, Vol. 3, No 5, pp. 399–404 (6–351.)

TRYON, H., 1889: Insect and Fungus Pests, pp. 238.

VOUKASSOVITCH, P., 1917: Observations Biologiques sur les Parasites de Plutella maculipennis, Curtis *Rev. Path, Veg Ent. Agric.*, 14, fasc 2, pp. 113–115. (16–73.)

WHITEHEAD, C F., 1894: Board of Agriculture and Fisheries, 4th Ed., 1905. Leaflet 22.

NOTE.—The figures in parentheses above refer to the volume and page respectively in the "Review of Applied Entomology," Series A where extracts of the articles referred to may be seen.

The writer's thanks are due to members of the Fields Division for their willing help and co-operation in the prosecution of this work; to the Imperial Institute of Entomology for the identification of the parasites reared; and to Dr. G. H. Cunningham and Mr. J. C. Neill, of the Plant Research Station, for helpful suggestions in the preparation of this article.

INTENSIVE GRASS-FARMING.

DAIRY-FARM EXPERIMENTS AT MANAWARU, SEASON 1929–30.

J. W WOODCOCK, Instructor in Agriculture, Fields Division.

THE experiments in rotational grazing and intensive manuring commenced on Mr. John Ward's farm at Manawaru, Piako County, in 1927, and described in this *Journal* for December, 1928, and October, 1929, was continued during the 1929–30 season. Although the early experimental work was hampered to some extent by various setbacks in the form of a severe drought in 1927 and floods in 1928, information was obtained on the technique of rotational grazing and the usefulness of intensive manuring and improved methods of grass utilization for increasing butterfat production. Production was increased from 161 lb. of butterfat per acre in the 1926–27 season to 212½ lb. per acre in the 1928–29 season.

The information gained on rotational grazing from the last two seasons' experience may be briefly stated as follows :—

(1) The storing-up of a reserve of hay and ensilage should always precede the adoption of more intensive methods of grass-farming and an increase in the number of the dairy herd.

(2) The size of the fields on rotationally grazed farms is determined by the rate of stocking, and it would appear that this should be at the rate of twelve to eighteen cows per acre, more or less, according to the fertility of the land.

(3) A good even grass-growth 3 in. to 4 in. high will give two grazing-days of twenty-four hours each for twelve to eighteen cows per acre.

(4) When the grass-recovery period is prolonged through adverse weather conditions the feed produced by the pastures should be supplemented with grass ensilage, concentrates, or a combination of the two.

During the 1929–30 season the foregoing conditions were put into effect or further investigated. The farm was further subdivided so that it consisted of sixteen fields of approximately 3 acres each. All fields were supplied with water, and each field opened on to the central race. The lay-out is shown in Fig. 1.

MANURING AND MANAGEMENT OF THE PASTURES.

Three dressings of superphosphate, each at the rate of 2 cwt. per acre, were applied to all pastures during July and December, 1929, and April, 1930. Eight of the fields were top-dressed with 2 cwt. of sulphate of ammonia during July, and again with 1 cwt. in April, No further dressings of lime were applied during the 1929–30 season, but the ½-chain strips across each field treated with potash in 1929 were again top-dressed with 2 cwt. per acre of 30 per cent. potash salts in June, 1930. Frequent observations made during the season failed to locate any difference, either in pasture composition, colour, or grazing, on the limed areas or on the potash strips, from the areas not treated.

Fields were grazed as far as possible when the grass-growth was about 3 in. to 4 in. high, and the herd of thirty-six cows was generally able to consume this in two days. Dry stock followed the main herd to clean up thoroughly any residual grass, and the mower was used to trim off seed-heads where necessary. During the winter, spring, and early summer the fields were harrowed after each grazing. No set rotation was followed for grazing the fields, but the milking herd after feeding off one field was moved to the one next ready for grazing. Any tendency for the feed to get ahead of the herd was checked by closing the more advanced fields for hay and ensilage. Four fields were closed for ensilage in September, and three for hay in October. As the weather turned out to be so favourable for grass-growth right up to mid-February another field could safely have been closed, but in October it was not considered safe to do this, and the control of the pastures did not suffer to any extent by neglecting to do so.

The ensilage was made during November in two stacks each calculated to hold about 36 tons of material, and harvested before the flowering of the grass took place. A large stack of hay was harvested from three fields during December.

VALUE OF NITROGEN AS A TOP-DRESSING.

An investigation into the usefulness of nitrogenous fertilizers for grassland has been carried out on Mr. Ward's farm for the past three seasons, but up to the present little has been published on this phase of the experimental work.

During the 1927–28 season (see *Journal*, December, 1928) sulphate of ammonia was applied in early November and again in March, but on account of the summer drought only the March application proved of benefit. During the following season, 1928–29, when four dressings each of 1 cwt. per acre were applied to six of the fields, the effects of the July dressings were almost nullified by the floods which followed soon after application. Dressings applied in October and December did not give any appreciable response, but the March dressings stimulated growth during the late autumn and provided useful feed in the early winter.

The trials on this farm and others conducted elsewhere in Auckland Province indicate that only the July–August and March–April dressings are likely to be payable, and that the best results are obtained if rain falls immediately after the application of the nitrogenous fertilizer. Dressings during May or June may give good results provided rain is plentiful and severe frosts do not occur soon after application. Applications prior to dry weather generally give little immediate response, and may even do temporary harm to the pasture by "burning" with subsequent suppression of clovers.

In the 1929-30 season eight fields, comprising half the farm, were treated with 2 cwt. of sulphate of ammonia. The dressings commenced on 9th July and were completed on 24th August. The nitrogen-treated fields were selected so that each could be compared with a control field alongside which had been originally part of the same pasture. Only two of the nitrogen fields had previously received any different treatment from the corresponding control fields. These two nitrogen fields had received four dressings of sulphate of ammonia during the previous season, while the controls had none.

In order to view the results of the late winter dressings in proper perspective it is necessary to divide the time between the first grazings and the autumn applications into four periods. The first period extended from 15th August to 12th October, when all fields were being grazed and during which any extra feed was most desirable. The second period, between 12th October and 21st December, was one when

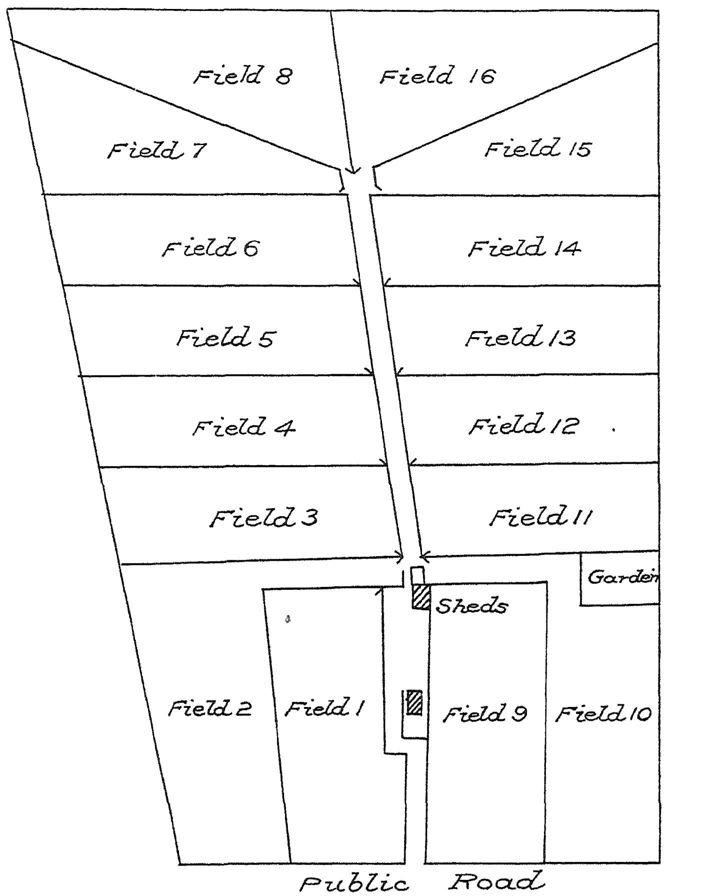

FIG. I. LAY-OUT OF MR. WARD'S FARM IN 1929–30 SEASON.
Fields approximately 3 acres each. Total area, 50 acres.

there was a superabundance of feed on the farm, and during which seven fields (21 acres) were closed for hay and ensilage. It is safe to say that in this period extra feed was least necessary, especially during such a season as the one under review. The third period, between 22nd December and 17th February, was one when there was ample feed, as the aftermaths of the hay and ensilage fields were available for grazing. The fourth period, between 18th February and 11th April, was a time of scarcity, as dry weather prevailed.

Table 1 shows the results of grazing the fields on the farm during each of the four periods described, expressed as cow-days per acre. Cow-days per acre are obtained by multiplying the number of cows grazing the particular field by the number of days grazed and dividing the resultant figure by the area. Dry stock following the main herd have also been taken into consideration, each animal being calculated as a fraction of a cow according to its age and type. Averaging the four periods the fields treated with nitrogen plus phosphate gave 187 cow-days per acre, and the control fields treated with phosphate gave 192 per acre, a difference of 5 cow-days in favour of the control. During the first period, however, there was a difference of 6·9 cow-days in favour of the nitrogen fields, and during the second period there was also a difference of 5·3 cow-days in their favour. During the third and fourth periods there were differences in favour of the controls of 7·3 cow-days and 9·9 cow-days per acre respectively.

Individual fields, however, have given widely different results, due no doubt to the diversity of composition and age of the pasture. Field 9, treated with nitrogen, gave substantial increases over the control Field 10 during all four periods, whereas Fields 13 and 16 failed to respond. These two fields are the ones already mentioned as having had slightly different previous treatment from their controls in that they received four applications of sulphate of ammonia during the 1928–29 season. These dressings had caused a marked depression of white clover in these fields, which, however, was not lasting in Field 13. This field, in common with Field 14, suffers from a lack of good rye-grass. Evidently these fields were sown down in 1927 with a poor type of rye-grass, which has failed to persist, and it is no doubt due to this fact that the poorest results were obtained from the nitrogen application to Field 13. Although nitrogen stimulates rye-grass to a marked extent, it cannot create what is not present in the first place, and experience goes to show that nitrogenous fertilizers should be applied only to those fields having a good proportion of rye-grass in their composition. This is borne out by the fact that those fields having the greatest amount of rye-grass gave the best results during the first period. The value of nitrogenous fertilizers for providing early spring feed is apparently greatest on dominant rye-grass pastures, and on many dairy-farms the adoption of nitrogen top-dressing will not be profitable until the pastures are improved by re-establishment with truly perennial strains of rye-grass.

The nitrogenous dressings applied in July on this farm have not produced any extra growth for the season as a whole, but they have promoted extra growth in the spring at the expense of summer growth. It was the stimulation of rye-grass which was largely responsible for the extra spring feed, and it happens that the subsequent depression coincided with the seasonal decline of rye-grass.

Nitrogenous fertilizers are therefore useful for stimulating an early spring growth of rye-grass, and any decline in production from nitrogen-treated fields later in the season may be more than compensated for by the extra value of grass-growth in the early spring. The provision of a good supply of grass for early-calving cows has a marked effect on production over the whole season, and the value of the feed

produced in the early spring with nitrogenous fertilizers cannot be expressed merely in terms of the extra butterfat produced in the early spring.

Table 1.—Grazing-days from Nitrogen and Control Fields.

Field No.	Treatment.	Cow-days per acre at various Periods.				
		15/8/29 to 12/10/29.	13/10/29 to 21/12/29.	22/12/29 to 17/2/30.	18/2/30 to 11/4/30.	Total.
1	Sulphate of ammonia	55	106	46	27	234
2	Control	38	112	50	36	236
	Difference* ..	+17	−6	−4	−9	−2
3	Sulphate of ammonia	59	†	†	†	59
4	Control	60	†	†	†	60
	Difference ..	−1	..	..	..	−1
5	Sulphate of ammonia	38	‡	30	46	114
6	Control	26	‡	29	85	140
	Difference ..	+12	..	+1	−39	−26
7	Control	12	‡	54	50	116
8	Sulphate of ammonia	22	‡	48	58	128
	Difference ..	+10	..	−6	+8	+12
9	Sulphate of ammonia	69	152	52	41	314
10	Control	45	120	44	40	249
	Difference.. ..	+24	+32	+8	+1	+65
11	Sulphate of ammonia	67	124	64	52	307
12	Control	64	115	66	52	297
	Difference.. ..	+3	+9	−2	..	+10
13	Sulphate of ammonia	71	91	63	32	257
14	Control	75	105	75	62	317
	Difference.. ..	−4	−14	−12	−30	−60
15	Control	25	‡	57	42	124
16	Sulphate of ammonia	23	‡	26	40	89
	Difference.. ..	−2	..	−31	−2	−35
Mean difference in favour of nitrogen		6·9	5·3	..	..	..
Mean difference in favour of controls		..	..	7·3	9·9	5·0

* Differences in favour of sulphate of ammonia indicated by + sign; those in favour of control indicated by − sign.
† Control field cut for hay; nitrogen field grazed. Treatments not comparable after cutting.
‡ Closed for hay or ensilage.

NOTE.—Control fields received phosphates only Nitrogen fields received the same quantity of phosphate as the controls and 2 cwt. of sulphate of ammonia in July-August in addition.

MANAGEMENT OF THE DAIRY HERD.

The milking herd on Mr. Ward's farm during the 1929–30 season consisted of thirty-six Friesian cows, most of which were pedigree animals. There were also five heifers, five calves, two bulls, and two working-horses on the farm.

Unfortunately, a number of the cows calved late, and this had a detrimental effect on production during the early part of the season. At the end of September only twenty-six cows were in milk, compared with thirty-five in September, 1928, but production per cow last spring was much higher than that during the previous spring, due to a large extent to better pasture-growth.

Until the time of calving cows were run with the young stock to clean up the pastures after the main herd. During October, when not more than thirty milking-cows were in the herd, which meant a maximum of ten cows per acre, the primary grazing of the fields was not as thorough as it should have been, and the dry stock had difficulty in cleaning up the pastures. However, during November, Mr. Ward was able to obtain thirteen additional cows as followers to clean up the pastures after the milking herd, and with a total of nineteen followers during November better control of pastures was obtained.

SUPPLEMENTARY FEED.

The difficulty of providing a continuous supply of grass during the dry periods which usually occur during the summer in Auckland Province has not been completely solved at the present time. If ensilage is available it may be the means of supplementing the grass shortage to a certain extent, particularly if such ensilage is made from grass in an immature stage. During the season of 1929–30 the growth during spring was prolific, so that there was no difficulty in making sufficient ensilage on many farms, not only for immediate requirements but also as a reserve for future seasons. On Mr. Ward's farm 12 acres of grass was converted into ensilage, and during April and May some of the material was fed out to the dairy herd. With the flush of feed in February it was difficult to foresee any necessity for supplementary feeding during the autumn, but a dry spell came in the late autumn and was immediately followed by rather severe frosts. Under these circumstances, with little or no growth on the pastures, grass had to be entirely replaced by ensilage, which was fed out from 20th April until the end of May, the material being that harvested from immature grass in early November.

During the 1928–29 season, when no ensilage was available, concentrates were fed to the dairy herd, and it is considered that production was maintained to a certain extent until the flush of grass followed the advent of rains during March. An experiment to investigate the value of concentrate feeding during dry spells was carried out during the 1929–30 season. The herd was divided in December into two groups of eighteen cows in each, and, taking age, date of calving, and previous production into account, the two groups were as even as it was possible to arrange. Daily milk-yield and butterfat tests were taken from each group, and, by changing individual cows from one to the other, two groups of very even production had been selected by the

end of January. For the eleven days prior to the commencement of the experiment—from 5th to 16th February inclusive—"A" group had given 215·2 lb. butterfat and "B" group 215·4 lb.

The concentrate mixture used for the experiment consisted of 25 lb. crushed oats, 25 lb. crushed maize, 33 lb. linseed nuts, and 17 lb. bran. The nutritive ratio of this mixture is 1 to 3·6, which is a fairly narrow one.

Feeding commenced on 16th February, when Group A received 2 lb. per head per day of the above-mentioned mixture, while Group B received none. At that time there was quite sufficient grass on the farm and concentrates did not appear very necessary, but in the light of subsequent events it was not by any means too early. The ration

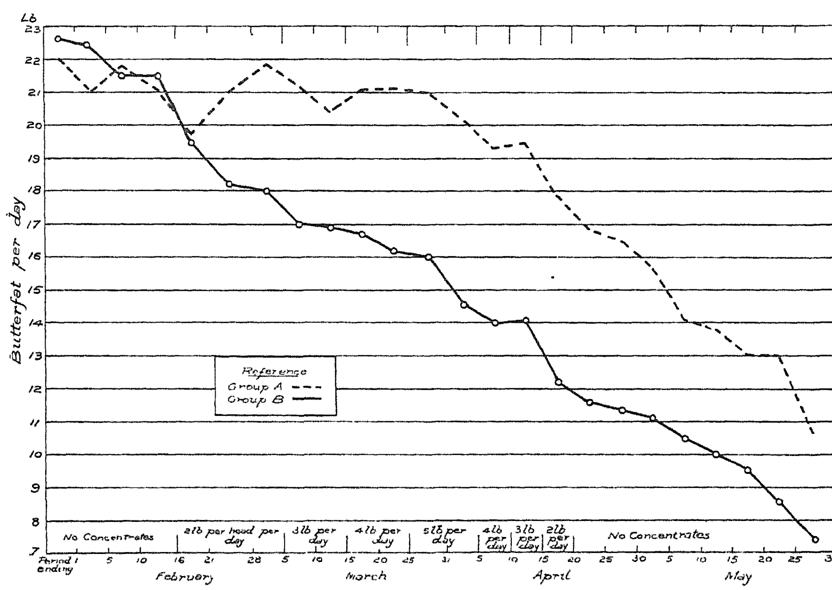

FIG. 2. GRAPH SHOWING AVERAGE DAILY PRODUCTION OF TWO GROUPS OF COWS DURING FIVE-DAY OR SIX-DAY PERIODS FROM 1ST FEBRUARY TO 31ST MAY, 1930, GROUP "A" RECEIVING CONCENTRATES, GROUP "B" NO CONCENTRATES.

was gradually increased from 2 lb. daily until 25th March, when a maximum of 5 lb. per head per day was reached. On 5th April the ration was gradually reduced, and concentrate feeding ceased altogether on 20th April.

Fig. 2 shows graphically the average daily production of the two groups during periods from 1st February to 31st May. It will be seen that following the period ending 1st February, when both herds had reached their peak, production had a downward tendency which was not immediately checked by the concentrate feeding of Group A. This was doubtless due to the difficulty in getting several cows to take the feed for a start, especially when fresh succulent grass was available in the fields. From February until the end of March, however, the production of Group A was maintained at a high level, while the production

of Group B steadily declined. After the end of March and particularly after 15th April, with the cessation of concentrate feeding, the production of Group A declined at about the same rate as that of Group B, but the margin of 4 lb. to 5 lb. butterfat per day between the two groups was maintained until the end of May, when the cows were dried off.

The main object in feeding concentrates during the dry period is to maintain production, if possible, until the flush of grass which usually appears in the autumn may be consumed by cows which are still in high production. That flush of grass, however, failed to materialize during the autumn of 1930, and the commencement of the dry period was not only unusually late but the period was also prolonged, so that there was a shortage of feed up to the time the cows were dried off To the concentrate must be credited the extra production not only during the actual feeding, but from then on until the end of May. The extra production of Group A over Group B during this time amounted to 434 lb. butterfat. The concentrates cost £30 landed on the farm, so that at 1s. 5d. per pound the extra butterfat produced would just have paid for the cost. Unfortunately, butterfat prices during the autumn were much lower than 1s. 5d., but it must be remembered that both cost of concentrate and price of butterfat are variable and will to a large extent determine the economy of concentrate feeding. A dry spell occurring in early February followed by rains during March, conditions which prevailed during the 1928–29 season, would also be more favourable to concentrate feeding. Further investigation is needed as to the correct nutritive ratio to be used and the foods that could be most economically employed.

Butterfat Production.

During the 1929–30 season there was a satisfactory increase in butterfat production over that obtained in 1928–29, and, as will be seen from the figures of production for the last four seasons given in Table 2, there has been a steady increase each year since the experiments were commenced in 1927.

Table 2.—Butterfat Production on Mr. Ward's Farm.

Season.	Number of Fields	Butterfat to the End of December.	Butterfat to the End of May.	Butterfat per Acre.	Number of Cows	Butterfat per Cow.	Fertilizers.	
							Superphosphate.	Sulphate of Ammonia.
		lb.	lb.	lb.		lb.	Tons.	Tons
1926–27..	8	4,111	8,043	161	27	298	7½	..
1927–28..	10	5,812	10,173	203½	32	318	14	2
1928–29..	13	5,385	10,624	212½	37	287	22½	4½
1929–30..	16	5,679	11,027	220½	36	306	14½	3½

This production has been obtained in spite of difficulties which have been experienced in the form of drought in 1927, floods in 1928, and the late calving of many cows in 1929. While the latter is by no means an unusual occurrence on dairy-farms, it is generally realized that early calving is necessary for higher production. Although the past season was a good one for production, and ample feed was

available throughout the spring and summer, the shortage of cows in milk with which to convert that grass into butterfat in the early period was to some extent reflected in the output.

In the graph Fig. 3 the distribution of production for the past four seasons is shown. Figures are taken from actual ten-day periods, and in those months having more or less than thirty days the extra day has been ignored. In February two days' production, one from January and one from March, have been added. This eliminates misleading peaks when the third period in a month contains eleven days. There has been a tendency during the last two seasons for production to be more evenly spread through the season, and it has

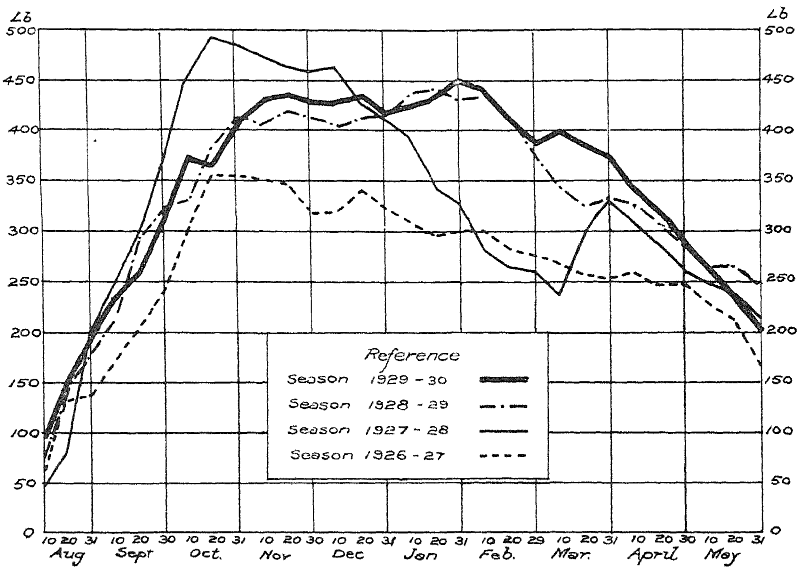

FIG 3. GRAPH SHOWING BUTTERFAT PRODUCTION OF MR. WARD'S FARM FOR LAST FOUR SEASONS.

become evident that this will occur under a system of rotational grazing when pastures are kept under control in late spring and early summer, when a dressing of superphosphate is applied in November–December, and when supplementary feed is available for dry spells. A high production about October when feed is in abundance, with a rapid falling-off until the end of the season coinciding with the appearance of uncontrolled pasture, is generally a feature of dairy-farms under the extensive system. There is no reason why production should not be as high in October and maintained at a high level until March, or even later, on farms under the rotational-grazing system.

SUMMARIZED POINTS.

(1) Nitrogenous fertilizers are useful for stimulating an early spring growth of rye-grass, but the adoption of nitrogen top-dressing on many farms will not be profitable until the pastures are improved by re-establishment with truly perennial strains of rye-grass.

(2) Under rotational grazing approximately half the farm may be closed for hay and ensilage in a good season.

(3) The use of 6 cwt. of superphosphate annually, divided into three dressings of 2 cwt. per acre applied a few weeks before the extra feed is required, may be considered a satisfactory practice on intensively managed dairy-farms in this and the Waikato district generally.

(4) Concentrates may prove efficient in maintaining production during dry periods, the economic results varying with the cost of concentrate, the price obtained for butterfat, and the weather conditions following the dry period.

General.

Further experimental work is being conducted on Mr. Ward's farm during the current season. It is not intended to further subdivide the farm nor to increase the quantity of fertilizers, as it is considered that the manurial programme carried out during the 1929–30 season is, with minor modifications, satisfactory. By keeping the factors of subdivision and manuring constant it will be possible to gain valuable information on the economic aspect of intensive grazing.

Thanks are again tendered to Mr. Ward for his hearty co-operation throughout the season, and to the management of the Manawaru Cheese Factory for their courtesy in supplying figures of milk-tests.

RAISING TREES FROM SEED ON THE FARM.

State Forest Service.

In order to avoid the possibility of having to use young trees which may arrive at their destination in a heated condition, farmers and others living a long distance from supplying distributing nurseries, or at places not easily reached by rail or steamer, are recommended to procure seeds and raise their own plants.

Clean ground should be chosen, and after sowing the seeds they should be protected from birds and shaded with scrim, manuka scrub, or boughs of trees. The covering soil for conifers should not exceed ¼ in. in depth, while eucalypt seeds should be barely covered and no more—say, about ⅛ in. Sowing should be done during the months of October, November, or December. In good land or in warm districts a late sowing is best, as there is then less danger of the plants becoming too large for safe transplanting. Germination will usually be completed about three or four weeks after the sowing is made. Seed (except of wattles) should be sown as received and not soaked or scalded.

A crop of trees should not exceed from 300 to 500 seedlings to the square yard of seed-bed actually occupied by the crop, and not taking into account the spaces between the beds or drills. As the germinative capacity of seed varies every year, it is possible to give only an approximate idea of the quantity required for a given number of trees without testing the seed. The accompanying table shows the average number of seedlings usually produced from 1 lb. of seed.

Name of Tree.	Quantity required per Acre for Broadcast Sowing.	Number of Seedlings usually expected from 1 lb. of Seed.	
		North Island.	South Island.
Cupressus Lawsoniana ..	½ lb	20,000	..
Cupressus macrocarpa ..	4 lb	5,000	5,000
Pinus radiata	1 lb.	10,000	6,000
Pinus Laricio	..	..	6,000
Pinus muricata	½ lb.	20,000	10,000
Pinus pinaster	..	..	4,000
Pinus ponderosa	2 lb.	4,500	4,500
Pseudo-tsuga Douglasii ..	¾ lb.	15,000	4,000
*Sequoia sempervirens** ..	..	1,500	..
Eucalyptus amygdalina ..	2 lb	15,000	..
Eucalyptus Gunnii	6 oz.	30,000	25,000
Eucalyptus coriacea	4 lb.	3,000	..
Eucalyptus botryoides ..	6 oz	30,000	..
Eucalyptus eugenioides ..	2 lb.	15,000	..
Eucalyptus fastigata ..	2 lb.	6,000	..
Eucalyptus gigantea	2 lb.	7,000	..
Eucalyptus Macarthuri ..	6 oz	30,000	20,000
Eucalyptus Muelleriana ..	2 lb.	5,000	..
Eucalyptus obliqua	2 lb	7,000	..
Eucalyptus ovata	6 oz	30,000	..
Eucalyptus pilularis	4 lb	3,000	..
Eucalyptus regnans	2 lb	6,000	6,000
Eucalyptus saligna	1 lb.	15,000	..
Eucalyptus viminalis	6 oz	30,000	20,000

* The number is extremely variable with this species.

The State Forest Service has for disposal large and small quantities of reliable tree-seeds, collected, where possible, from acclimatized trees in New Zealand. Imported seeds are procured from the most reliable sources. All seed is tested for germination before being disposed of, and to any one accustomed to ordinary garden-work the raising of small crops sufficient for the average farmer's requirements is an easy matter.

Sodium Chlorate and Lime-sulphur.—The Fields Division advises that spray-pumps in which lime-sulphur has been used should be thoroughly washed out prior to being used for spraying weeds with sodium chlorate. The combination of sulphur and sodium chlorate is dangerous, and may bring about an explosion.

Horse-breeding in New Zealand.—In his annual report for 1929–30 the Director of the Live-stock Division, Mr. J. Lyons, refers to this subject as follows: Prices for horses have been good—in fact, quite up to the average of recent seasons; nevertheless, the breeding of all classes of horses, with the exception of thoroughbreds, seems to be in abeyance and more or less neglected. There are still a few enthusiasts amongst Clydesdale breeders who take an interest in this class of stock. It is doubtful, however, whether enough are being bred to meet even the present demands, and if the present indifference continues it is a question whether sufficient will be reared to meet the demand for farm-work. On account of the limited number of mares being put to breeding purposes, the keeping of an entire horse has become an unprofitable proposition in many districts. Thus, because of no satisfactory sire being available, many farmers who would otherwise rear a foal or two each season are debarred from doing so. Should this condition extend it will mean that there will not be enough horses reared to meet the demand for farming purposes, and, as a certain number will still be required, those available may reach prohibitive prices.

SEASONAL NOTES.

THE FARM.

Ensilage and the Pastures.

ATTENTION was directed in these notes last month to the value of ensilage as a means not only of providing reserves of feed for use when fresh grass is in scant supply, but also of bringing about proper control of pasture-growth. Haymaking at times can be used for these same purposes, and some farmers ask why ensilage is being suggested as a preferable alternative to hay. Ensilage is often markedly more serviceable and suitable than haymaking, after making full allowance for the fact that it involves dealing with a much greater weight of material than does haymaking. Ensilage is superior to haymaking under many circumstances, primarily because it allows of surplus feed to be conserved when it should be conserved. This is because silage can be made irrespective of the weather conditions, which so often either delay haymaking or result in the loss or serious deterioration of the crop before it is saved as hay.

Conserving surplus growth when it should be done rather than when the weather permits it to be done is beneficial in three distinct ways. In the first place, the conserved material is of greater feeding value, in that there is no reason for it to be characterized by the excessive stemminess and consequent poor digestibility that characterizes much of the hay that is made. In the second place, the farmer is not forced to resort to the rush periods of work which are a feature of haymaking and which often lead to costly neglect of other important farm-work. In the third place, the pastures benefit in a dual manner when surplus growth is removed at the right time. No rank growth, with its consequent harmful opening-up of the turf, develops, and a better and more reliable aftermath can be expected when the surplus growth is removed at an early stage. These are some of the important facts that make ensilage frequently preferable to haymaking. A further advantage is that it gives reserves of feed which are practically free from damage from vermin and from fire-risk.

In addition, ensilage can at times be resorted to in order to place in reserve crops that could be satisfactorily dealt with in no other manner. For instance, the first cut from a lucerne area ordinarily becomes available each season at a time when conditions are extremely unfavourable for haymaking, and when there is nothing to be gained by giving the stock green feed in addition to that which is obtainable from the fields under grazing. Often plants other than lucerne occur freely in the first growth of each season on an area devoted to lucerne. When this is the case it is much against good future yields from the lucerne to leave the growth unmown until good haymaking weather can be expected. The only satisfactory course is ensilage. In like manner growth containing heavy quantities of weeds, such as thistles, can at times be conserved in edible form as ensilage, whereas in the form of hay the stock would not consume it.

By adopting the practice of ensilage a farmer may build up reserves of feed which could, if necessary, be fed with satisfactory results in summer as well as in winter, whereas haymaking gives a reserve which generally cannot be so satisfactorily used at both seasons. When there are reasonable grounds for expecting that silage may be utilized for the feeding of stock when they are producing milk, then it is highly desirable that the silage be made from material cut at an immature stage before there has

been much or any development of bloom. Silage made from stemmy, mature green material when fed to milking stock to supplement pastures may not be superior to hay—indeed, it may be inferior to hay well saved from material cut at an early stage.

From these merits of ensilage it is not to be concluded that ensilage should always necessarily be adopted to the exclusion of haymaking. Often, indeed, both silage and hay may well be made on the one farm; by making silage early in the season when broken weather is likely, and hay later on when good weather is likely, more surplus feed is conserved than could be done otherwise, and at the same time the labour of doing this is well distributed so that no serious dislocation of farm-routine work occurs. Summed up, the intrinsic worth of ensilage comes from the facts that it can be practised irrespective of weather, and that herbage which cannot be used satisfactorily for hay can at times be better utilized for ensilage.

Some farmers refrain from ensilage on account of the belief that it is a somewhat difficult process with which to attain success. Actually it is not at all difficult. It is less difficult than much other farm-work which is generally undertaken without hesitation; it probably calls for less skill than haymaking under average conditions. All this is rather well illustrated by the method of making the winning stack in last season's extensive Taranaki ensilage competitions. According to the report of the judge, Mr. J. M. Smith, "the crop was cut while the herbage was in a young growing condition. The material came in straight from the mower, and the stack was built to a height of 8 ft. the first day. Building was continued and completed the following day, when the stack went to a height of 15 ft., and a covering of 15 in. of soil was put on straight away. The stack was 21 ft. square." It cannot be held that there is anything intricate about such a practice. A detailed account of ensilage-making is given in Bulletin 146 of this Department.

Ensilage does not tax the labour resources of the ordinary farm if suitable modern equipment is used. Three to four workers will make really good progress with equipment which can be purchased for from £40 to £50, and which also serves excellently for haymaking. Where a suitable site for a pit is available only a portion of the expenditure just mentioned will suffice under many circumstances, and in numbers of cases a team of two workers has efficiently saved silage.

From the dependable field evidence contained in the separate article appearing in this issue it will be clear that there are grounds for the belief that ultimately ensilage will be of the great value to our sheep-farming that it is already to our dairying. Proper pasture utilization is the sphere in which many farmers show most scope for improvement. What the governor is in the working of the engine, that is ensilage in the utilizing of pastures—control.

The smaller the amount of silage saved the greater is the proportion of waste. Hence it sometimes becomes advisable to ensile together material from several sources. For instance, in the early part of the season by conserving together surplus material from pastures, from green cereals, and from lucerne, many farmers would have a much more satisfactory bulk of material to work with than would be the case were each crop treated separately.

Other Pasture-work.

Topping of the pastures with a mower to remove rank growth should often be carried out in November. Many farmers do this work too late. If it is done in November it is a reliable means of increasing the late summer and autumn development of fresh leafy pasture-growth which is so often in scant supply.

Harrowing of pastures in November is frequently needed, principally for the purpose of breaking up animal droppings. To distribute such droppings thoroughly it is often well to harrow up and down in one direction instead of round and round a paddock, and then to give a second stroke of the harrows at right angles to the first one.

Supplementary Forage Crops.

Mangels.—Of the mangel, which generally may be sown in October or November, it is important to remember that success comes only from good treatment. If it is not grown under conditions providing high fertility and thorough cultivation—to which in combination it responds fruitfully—disappointing yields may be depended upon Hence for the mangel if a good soil is not available, then fertility should be built up by free use of fertilizer A mixture of equal parts of superphosphate and bonedust supplemented by 2 cwt of kainit or agricultural salt will over wide conditions give good results. The kainit or salt will fairly readily cause seedling injury if brought into proximity with the germinating seed, and so should generally be broadcast before seed-sowing. At times depressed yields follow the sowing of mangels before the soil is warm enough. This is particularly likely to occur on land which is not thoroughly drained.

Turnips and Swedes—The main sowing of turnips and swedes ordinarily takes place in November, but where grass-grub damage is apt to be serious, as at times is the case in Canterbury in particular, then the special measures mentioned in a subsequent paragraph need to be considered That seed-injury is likely to take place when the seed of any of these crops is mixed with superphosphate, even at a short time prior to sowing, is fairly generally known, but it is doubtful whether some realize how serious this injury is likely to be. A reduced germination may also be caused by contact between seed and such manures as dried blood, potash salts, and sulphate of ammonia Purple-top Mammoth, Red Paragon, and Green Globe are standard turnips of proved merit.

Carrots, which demand thorough cultivation, thrive best in a free loam, but may be grown satisfactorily on a wide range of soils. Matchless White and White Belgian are deservedly probably the most popular varieties If the area of the crop is too large to allow of hand cultivation, carrots should be sown in drills 21 in. to 26 in. apart; whereas if hand cultivation is contemplated drills 14 in. to 18 in. apart are suitable, using about 1 lb. of seed per acre When carrots are to be fed to sheep, Guerande is the most suitable variety. This variety should be sown in drills 21 in. to 28 in. apart, at the rate of 1½ lb. seed per acre; it should be intertilled but not thinned. Carrots may be sown in November, and generally respond profitably to dressings of 2 cwt. to 3 cwt. of an artificial fertilizer of which superphosphate and bonedust are the principal constituents

Maize and Millet are useful for green feed particularly in districts where rape does not thrive. Both crops demand warmth and sometimes are sown earlier then is advisable. In many parts they should not be sown before the last week in November or the first part of December.

During spring and early summer it is of value as a means towards saving of labour to keep in mind constantly that plants are in a critically delicate condition in the seedling stage Hence weed seedlings should be attacked at this stage. When relatively small seeds, such as lucerne or carrots, are to be sown it is well to destroy by suitable cultivation crops of weed seedlings which appear prior to sowing, and to attack as soon as possible such weed seedlings which develop after sowing the crop.

Lucerne.

Lucerne is similar to the mangel in that it calls for warm germinating conditions. There is nothing to be gained by sowing it somewhat early

when the soil is still cold Under many conditions November or December is quite early enough. Opportunity should be taken of the intervening period to destroy by suitable cultivation any crops of weed seedlings that develop. Another important matter in lucerne-establishment is soil inoculation Unless the soil is provided with the particular micro-organisms with which lucerne co-operates, to the mutual advantage of both, then failure with the lucerne will follow. There is open to the farmer no practicable way of discovering before growing the crop whether his soil is inhabited by the requisite organisms This being so, the safest course is to provide the organisms. Supplies of the necessary organisms are provided free of charge by this Department How to obtain these supplies and how to use them may be learnt by applying to local officers of the Department of Agriculture.

Lucerne requires a well-prepared seed-bed, fine and firm. Generally lime may advantageously be applied at the last cultivation and disked in. It is important to remember that serious harm results from sowing lucerne-seed with superphosphate—the soil-inoculating organisms are destroyed. Marlborough and Hunter River strains are usually the most satisfactory seed. In the drier parts of the South Island 10 lb. to 14 lb. of seed per acre, sown in drills 7 in. apart, is usually enough, while in the wetter parts of the Dominion 15 lb. to 18 lb. is usually sown.

Established fields of lucerne generally require to be mown during November. As flower-development is at times unduly delayed in the spring the most reliable indication of when mowing should be done is frequently the appearance of fresh shoots at the base of plants. Because of weather conditions it is usually well to arrange for the first cut of the season from a lucerne area to be made into silage.

Precautions against the Grass-grub Beetle.

Over extensive areas the main flight of the beetle of the grass-grub occurs between mid-November and mid-December. Because of this, in districts where the grub is prevalent it may be sound practice to so delay the sowing of crops such as turnips and swedes that the seedlings will not have appeared above ground when the main beetle-flight occurs. This may mean the sowing of such crops at approximately Christmas-time in order to avoid the seedlings being destroyed by the beetles. Another point arising out of the flight of these beetles is that they will not deposit eggs on ground devoid of herbage Hence, land which is to be sown in new pasture or in lucerne may sometimes with advantage be kept bare when the main beetle-flight is expected.

—*R. P. Connell, Fields Division, Palmerston North.*

Precautions at Shearing-time against Caseous Lymphadenitis.

When the sheep have been mustered for shearing, each animal should be examined carefully for the presence of enlarged glands or ruptured abscesses, and all those in which enlarged glands are detected should be set aside. These sheep should be kept back and not shorn until after all the rest of the flock. In shearing them special care should be taken to apply disinfectant to all wounds inflicted. They should preferably be blade-shorn, and the shears should be frequently dipped in an antiseptic fluid. One part of non-poisonous dip in thirty of water, or, alternatively, kerosene alone or equal parts of tincture of iodine and water answers this purpose.

Every wound made during the shearing of the apparently unaffected sheep, as well as those on affected ones, should be carefully disinfected. This can be done by using one or other of the above-mentioned antiseptics. Stockholm tar is in common use and is good from the disinfectant viewpoint.

It, however, clings to the skin, and later, to the growing wool, and is liable to thereby depreciate the wool from the manufacturers' standpoint.

Shear blades should be cleaned and disinfected frequently. This is easily done with blade shears, but owing to the oily accumulation liable to be present upon them machine shears are not so easily disinfected.

It is a wise and desirable precaution to saturate the soil of the yards with a strong antiseptic solution—say, one part of non-poisonous sheep dip to twenty parts of water.

In regard to the examination before shearing, the infected glands are almost invariably found at the front of each shoulder and in the fold of each flank. They can be readily detected, though the shoulder glands are a little below the surface of the skin. Not only must enlarged glands be sought by careful handling, but the skin and wool at these parts should be examined in order to detect the scars left by ruptured gland abscesses and collections of matter in the wool derived from these ruptured abscesses.

— *Live-stock Division.*

THE ORCHARD.

Spraying Points.

DURING October spraying for the control of diseases should take precedence over all other activities in the orchard. The germination of fungus spores will be taking place rapidly under the influences of rising temperatures and atmospheric humidity, and young fruit will become exposed and develop rapidly in size, thereby increasing the field of infection. It should be borne in mind that the end of this month, generally speaking, terminates the period during which the more concentrated spray-solutions can be applied with safety, and that the maintenance of the orchard free from infection by fungus diseases at the commencement of the season has a valuable influence up to the close of the growing-period. This statement also applies to the control of those insect pests the broods of which come forward in the early part of the season. "Prevention of increase and limitation of distribution" should be the slogan of all commercial fruitgrowers, this referring particularly to red-mite and apple leaf-hopper, both of these insects appearing as nature provides the foliage for their sustenance.

Last month's notes dealt with suitable spray programmes for the control of the principal fungous diseases and pests, but apple-leaf hopper was not included For the information of readers whose orchards are subject to infestations of this insect it may be mentioned that at the nymph stage the activity of the insect is much restricted, and in consequence control is more easily effected. An application of emulsified oil 1–150 plus Black Leaf 40 1–800 will give a 100-per-cent kill of those insects which come into actual contact with the solution. Thorough application of the spray, so that the under-surface of all foliage is wetted and no detail is missed, makes this possible.

Fireblight.

Careful watch in both infested and non-infested areas for the occurrence of this bacterial disease is a duty on the part of all orchardists in the interests of themselves and the industry as a whole. Primary infection becomes obvious with the blackening and withering of the blossoms, and later results of infection may be observed by the oozing of sap from the cankers following the breaking down of wood tissues in the limbs of the trees. The only means recognized as providing satisfactory control is that of cutting away (well outside the area infected) and destroying by burning all diseased parts. The diseased part of the tree is defined by discoloration of the cambium layers. In cases of tip or blossom infection removal should

take place at least 6 in. below discolored tissue, and in the case of large cankers on the main branches removal of the entire limb can be recommended. This somewhat drastic precaution is desirable in order to avoid the retention of infected surfaces over which ooze may have passed and which has become unnoticeable by drying off.

In addition to attention to the fruit-trees, it is of vital importance to fruitgrowers that all hawthorn growing in the vicinity should be kept under observation. Flowers should be closely examined during the blossoming period, bearing in mind that infection in the first instance may be comparatively localized, and that it is within the range of possibility to stamp out initial outbreaks of the disease.

Thinning of Fruit.

This work is of great value in the elimination of disease-infected fruit, together with regulation of the size of fruit and quantity of crop The results of systematic thinning are far-reaching, not only improving the crop for the current season, but determining in most instances the growth of the tree and subsequent development of the fruit-buds for the succeeding year It is not always an economic proposition to thin large stone-fruit trees, and such being the case severe cutting out of fruiting wood during the dormant season should be resorted to, especially in the case of peaches, nectarines, and Japanese plums Heavy cutting out of fruiting wood may appear a sacrifice at the time, but it is in most cases a really good investment in fruiting wood for the following season.

In thinning apples and pears, growers must be guided by the general condition of the trees. Robust trees likely to maintain their growth and size of fruit may be left with three fruits to the cluster ; others with less constitution should be thinned to two or even one fruit, according to vigour and variety. Generally short-stemmed spur-bearing varieties require more drastic thinning than long-stemmed lateral-bearing varieties, having in mind that opening-up of the clusters restricts the shelter and security afforded such insects as bronze-beetle and leaf-roller caterpillar.

Care of Grafts.

Results of reworking will become apparent towards the end of this month. Where failures have occurred it is not too late to retrieve the position by an addition of more scions, provided the wood has been kept dormant by complete burial in damp sand and stored in a cool place. Growth which arises from the cut-back branches should not be entirely removed until the following dormant pruning, pinching only being practised where the growth is likely to submerge the scions. Growths arising from the stocks have a definite value in the maintenance of excitement to the roots.

Cultivation.

The harrows should now be used to conserve all moisture obtained from the spring rains and to kill weed seedlings. In heavy soils this work is best carried out when the soil is damp but not wet.

—*M. Davey, Orchard Instructor, Mapua.*

Citrus Culture.

As stated in the last month's notes, a good deal of damage had taken place in some of the citrus plantations owing to severe winter frosts. As a result lemons that had been damaged have been placed on the market, probably by less experienced growers. This practice is not in the best interests of the industry. Fruits that have been damaged by frost are almost useless, and should not on any account be offered for sale. It is far better to accept the loss, cut the fruits from the trees, and have them

destroyed, otherwise a period of low prices for the locally-grown lemon is likely to be caused. A ready market can usually be found for all fruits of good quality and appearance, and it is in the interests of the industry as a whole that every effort be made to eliminate all inferior or low-grade fruit.

Diseases.—This is a matter that will now have to receive attention from all who take an interest in producing clean fruit. Soon after the main crop of blossoms have fallen the trees should be given a spraying of bordeaux 4–4–40 for the control of verrucosis. The lemon-tree flowers over an extended period, and needs to be continually under observation and repeated applications given as required in order to keep the whole crop clean and free from disease.

A sharp lookout should be kept for any borer that may be making its appearance. Where only small branches are affected it may be the best practice to cut them out and burn them With large branches a little benzine can be injected into the hole, and the hole then plugged with soap, putty, or clay.

As soon as the young growth commences a watch should be kept for red scale and thrips, as they soon become very troublesome The trees should be sprayed with red-oil 1–40 to 1–60 The question of the strength will depend somewhat upon the vigour and health of the tree Where trees are more or less debilitated the application made should be weaker than that given to trees in a more vigorous and healthy condition.

Cultivation —When soil conditions are favourable all cultural operations should be carried out as they are required. Neglect in carrying out any one operation at the correct time may in a measure nullify what is done in other directions —*L Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Economy on Right Lines.

TAKING into consideration the present high cost of foodstuffs and the low prices ruling for eggs, with the consequent reduced margin of profit over the cost of production, emphasis must be laid on the necessity for good management and for economy in every phase of the poultry business. It is the strict attention to small details that counts mostly in poultry-keeping, and which generally makes all the difference between success and failure.

While economy should be practised in every respect there must be no stint in the quantity of food supplied, which is too often the case when food costs are high and low egg prices prevail Instead of reducing the food ration the flock itself should be culled whenever possible. In the first place, a saving can be effected by marketing at once any old hens which give evidence of having passed their best period of usefulness. It must be admitted that the work of culling, at this season of the year requires considerable judgment, or the good layer is apt to be discarded and the poor one retained in the flock The heavy layer will usually be found to be in a more or less active, lean condition, while the birds possessing the greatest weight and well above the standard weight of their breed are the drones. The condition of the abdomen also is usually an indication of a bird's laying-capacity. In the heavy layer at this period of the year the abdomen will be found to be well developed, soft, and yielding to the touch, while in the poor layer its condition will be the reverse, indicating that the bird is turning the bulk of its food into surplus flesh and fat instead of into eggs.

There is nothing to gain but much to lose in allowing broody hens to sit on the nests for days or even weeks at a time. Not only does this

mean a serious loss in eggs, but it encourages the presence of vermin, and it is a fallacy to imagine that by giving the birds a rest in this manner at this time of the year they will come on to lay in the winter months. Such birds will generally moult with the other members of the flock at the usual moulting period.

Some persons resort to extremely cruel methods to put a hen off its broodiness—for instance, by confining it in a coop without food and water, or by dipping its head under water until it is nearly drowned The best plan is to confine the hen in a coop with a slatted or wire-netting bottom, the coop being raised clear of the ground by means of two legs at each end. If a bird is removed from her usual surroundings on the first sign of broodiness she will soon lose her desire to sit Broody hens should be given an ample supply of good nourishing food, in order to induce activity of the ovaries and a resumption of egg-laying in the shortest time possible

Unsuitable Meat-and-bone Meal.

A poultry-keeper recently informed me that he purchased a line of meat-and-bone meal, and that in the hope of promoting egg-production he fed some of this material in the morning mash—with disastrous results. Not only did the egg-yield decline but several of his birds died. On request, some of the meal was forwarded for examination Not only did it possess a decidedly objectionable odour, but its general appearance gave ample proof that the mixture had been prepared for fertilizer purposes, and not as a food for poultry This is not the first complaint received relative to mortality in poultry stock due to meat-and-bone mixtures manufactured for manurial purposes. It should be remembered that when meat-meal, or bone-meal is spoken of as a food for poultry, this applies only to the commodity which has been specially prepared as a food for stock, and to include such meal material of doubtful quality in a mash for fowls is simply inviting trouble. If fowls are to do their best it is of first importance that they be provided with palatable food.

Determination of Age of Ducks.

I have been asked how to ascertain definitely the age of a duck, but so far as I am aware there is no means by which this can be done. The condition of the windpipe, however, is a good guide as to whether or not a bird is an old or a young one. If the windpipe is hard to the touch it is safe to say the bird has passed the duckling stage. On the other hand, if the windpipe is soft and yielding it indicates that the bird is comparatively young. In applying this test to a live bird care must be taken that the windpipe is not squeezed to the extent of injuring the bird. In the case of a dead duck the condition of the upper part of the bill also gives a good indication of its age. In a young bird the bill can be pressed back and easily broken, while with an old one this will be found a difficult matter unless great pressure is used. Another method of deciding between an old and a young bird is the manner in which the breast-bone can be pierced with, say, a sharp hat-pin. With a young bird the bone can be pierced quite easily, but in the case of an old one considerably more pressure is required.

Lawn Clippings.

Lawn clippings, when they are short and in a succulent condition, make an ideal green food for fowls. On the other hand, if they are long and fibrous they are apt to form a tangled mass and will not leave the crop or gizzard, often resulting in heavy mortality. This applies particularly when the birds are not well supplied with sharp gravel grit.

Cleanliness.

Success in poultry-keeping depends to a large extent upon the manner in which its many details are attended to, but one which must be specially

acted upon is that of cleanliness. Many people have no idea of what cleanliness really means, they seem quite unconcerned if they become covered with vermin every time they enter the fowl-house, even if it is only to collect the eggs. Even where there are apparently no vermin present in the house, it is always a wise plan as a preventive to adopt the same measures as if they were present.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Artificial Increase.

ARTIFICIAL increase may be accomplished in several ways, but perhaps the most satisfactory are those by means of nuclei and division. A nucleus is best formed of two frames of emerging brood and young bees, one frame of honey, and one containing pollen. This must be completed by a virgin queen or a ripe cell. The nuclei may be utilized throughout the season for mating of queens for renewal, and at the end of the summer—if two or more are united, or if each one is reinforced by the addition of bees and brood from strong colonies—they may be wintered in safety and will form good stocks for the next season. No surplus can be expected from them the year of their installation.

In dividing it is best to wait till the colony is preparing to swarm and ripe queen-cells appear in the hive. The hive can then simply be split in two by putting half the bees and brood on another stand, taking care to leave queen-cells in each division, and for preference putting as much emerging brood in the half which is to be placed in a new position. This latter precaution is necessary in order to make up the wastage from the field-bees that will return to the old stand. Each hive can then be completed by filling the vacancies by drawn-out combs. The queen-cells in the queenless half will be nursed by the young bees, while those in the half containing the queen will be torn down by the bees when they find the hive depleted. If the apiarist wants to be quite sure of this being done he may search for the queen and remove her while the division is being made, afterwards putting her in the hive on the new stand.

The division method is advocated on account of its simplicity and the fact that there is no necessity for finding the queen before the operation. It is a most effectual preventive of swarming, and saves a great deal of trouble where increase is desired.

Supering.

In most districts November is early enough for the employment of supers, though much depends on weather conditions. If the weather is warm, the hives full of bees, and nectar coming in freely, the supers may now be added to at any time. However, it is of no use discouraging the bees by giving additional space before the weather is warm enough to justify it. If increase is required it is as well to confine the bees to one story till the hive is overflowing with bees. This is almost certain to produce a desire to swarm, and the hive can either be allowed to swarm naturally or be divided artificially.

When the first super is put on it is best, if possible, to fill it entirely or partially with drawn-out combs. If only foundation is available, one or two combs—not containing brood—may be removed from the bottom story to the top, and sheets of foundation put in their place. On no account disturb the brood until settled weather eventuates. If foundation is used in the super, queen-excluders should not be used, as the bees will rarely travel through the excluders to work the foundation, and will usually swarm. Do not bring excluders into use until the bees are quite accustomed to working in the supers.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

The Strawberry Crop.

THE strawberry crop will soon be ready for harvest, when, accompanied by castor sugar and cream, it will doubtless soon win its usual high position in the general estimation of the public To win and maintain this position the greatest care is needed in picking, packing, and despatch, so that the fruit is widely distributed and presented in a fresh appetizing manner. It is then without a rival in its class for a considerable period

In all the operations of fruitgrowing, picking the crop often demands more consideration from the operator than any other, a fact it is well to clearly realize when engaging assistance and supervising the work. It is usually the picker's business to gather *all* mature fruit, place the culinary fruit in special receptacles, and pack the dessert fruits neatly and fairly in punnets, which must be held in a cool place until they are promptly consigned to their destination. Such work demands unusual application and intelligence from the operator and constant supervision by the grower in order to obtain the best financial returns. Goods that are stale and stained, mixed in quality and maturity, and, worse still, topped off with fruit of a much higher quality and size, do a very great amount of harm to the trade by diminishing consumption.

Overripe berries, however fine, should be excluded from shipments consigned over long distances. Undersized and defective berries should be placed aside for culinary use, and crops affected with brown-rot fungus should never be sent to distant markets The wonderful display of choice fruit of this kind arriving at the markets is a strong contrast to the careless packing and shipping of goods which are slow in selling and disappointing to the unwary buyer.

Strawberries should be picked when they are dry and cool. The stage of ripeness should be considered in relation to the state of the weather and the time taken to reach the market. They should be firmest for shipping a long distance in hot weather, while for a nearby market in cool weather the ripening process may be almost complete. Dessert berries are picked with a stem ¼ in. long, and placed in the punnet in a compact manner, so that when they reach their destination the punnets are still full. If they have shaken down they are probably bruised, and even when filled up by the retailer are a disappointing "buy."

Other Small Fruits.

The season for gooseberry-pie also now commences, and it is a welcome addition to the short list of fresh fruit which is now available. The only hopeful suggestion in the marketing of gooseberries that may be made is probably one relating to sizing. It is not uncommon to see a wide range of sizes in a consignment, which would be much more attractive if it were put through a riddle and the two sizes packed separately.

Raspberries and currants will require occasional hoeing and cultivation to suppress weeds, but it should be done with care to avoid disturbing the fibrous roots which are very near the surface.

In the preparation of the land for planting small-fruits in the autumn or winter, a preliminary crop of some vegetable put in now is a profitable and satisfactory method, if care is taken to thoroughly clean the land meanwhile.

Tomatoes.

Where tomato-plants are to be planted outside they should be well watered in the boxes a day or so before removal. Manures commonly used before planting this crop are bonedust, superphosphate, and potash. The bonedust is generally best turned in deep, but the more soluble manures may be drilled in the rows a short time before planting out. The quantity required will depend on the quality of the soil, previous manurial treatment, and cropping; but in consideration of the excessive quantities often applied it is appropriate to observe that these good things when used to excess are very injurious to the plants and a waste of money.

Under glass without artificial heat the tomato crop now commences to ripen. In the drier localities it is customary to mulch down the surface with strawy stable-manure at this stage. It keeps the ground moist without getting sticky, and feeds the plants just when they require it. In damper localities this mulch is not used. But in either case feeding the plants fortnightly with liquid manure is now advisable to fill out the fruit and give it a good appearance. Nitrogenous manures which have been avoided up to the present may now be included, as growth is sufficiently advanced for this to be done with safety. Removing the lower leaves now to just beyond the bottom bunch, and carrying them out and destroying them, has many advantages, one being the facility it provides for the circulation of air through the crop.

Market-gardening.

Thinning and hoeing sums up the most important work for many crops at this season. Medium and even size in root crops, &c., is most desirable for market purposes. This may be obtained by suitable spacing and an intelligent use of manures. For this reason these two operations of hoeing and thinning are of paramount importance now. Hoeing weeds, in the seedling stage, during bright weather is a quick and easy method of destroying plant pests that might easily cause disaster. Thinning is best done in dull weather or at least when the ground is moist. Shortly after the operation is completed a light dressing of sulphate of ammonia is often beneficial.

Consideration should now be given to the preparation of the land for winter crops of leeks, savoys, cauliflower, broccoli, &c., which are planted out early in the New Year or even earlier. It is sometimes satisfactory to plant them out between the rows of early peas and potatoes.

In districts where late frosts threaten first sowings of cucumbers, marrows, and other gourds, the paper caps used for such crops in some parts of the United States might well be tried. Glassine or waxed papers 16 in by 18 in. in size are placed over each sowing. The paper is supported by an arch 4 in. high of galvanized wire and secured round the edges with soil. When the plants are about 1 in. high they are thinned, cultivated, and the cover replaced. Later, when the temperatures are safe, the cap is lifted on the lee side, so that the plant gets more air and is hardened off in preparation for the complete removal of the covers later.

Sowings this month consist chiefly of swedes and salads. Although it is not exactly a market vegetable at the present time, New Zealand spinach might well be sown now for home use. It is of special value in districts which experience a dry summer. Under such conditions it provides a green vegetable of good quality and quantity when other kinds are most difficult to grow In Europe it is highly esteemed for this purpose, and is sown in light soil in a sunny position so that when

established the plants are 3 ft. apart in each direction. It should be well watered in dry weather, when it will provide generously the tender shoots which are used.

The cutting season for asparagus ends during November, and many authorities consider that is the best time to manure the crop. A moderate dressing of equal quantities of potash, superphosphate, and nitrate of soda would be a suitable dressing in many instances.

The Homestead Garden.

Good progress is being made in the cultivation of our native plants, but the best results are only obtained when they are given a suitable soil and situation and grouped effectively. Very noticeable at the present time are the large groups of Chatham Island lily growing in moist, semi-shaded situations, where they are generally the picture of healthy vigour. The large handsome leaves, with four to five flower-stems to the plant, promise to make an even finer display as soon as the blossoms open.

Rhododendrons, azaleas, and heaths are greatly invigorated now by the removal of the old flower-heads with the seed they contain. Early attention of this kind will greatly improve the blossom next season Delphiniums and other herbaceous plants should have the young growth thinned and neatly staked.

—*W. C Hyde, Horticulturist, Wellington.*

AGRICULTURAL SHOWS, SEASON 1930-31.

THE following show-dates have been notified by agricultural and pastoral associations:—

Hawke's Bay A and P. Society: (**Royal Show**), Tomoana, 21st to 23rd October.
Poverty Bay A and P. Association: Gisborne, 28th and 29th October.
Wairarapa A. and P. Association: Carterton, 29th and 30th October.
Timaru A and P. Association: Timaru, 29th and 30th October.
Marlborough A and P. Association: Blenheim, 31st October and 1st November.
Manawatu A and P. Association: Palmerston North, 5th, 6th, and 7th November.
Northern A and P Association: Rangiora, 7th November.
Wanganui A. and P Association: Wanganui, 12th and 13th November.
Canterbury A. and P. Association: Christchurch, 13th and 14th November.
Egmont A. and P. Association · Hawera, 19th and 20th November.
Stratford A. and P. Association Stratford, 26th and 27th November.
Otago A. and P. Society: Dunedin, 26th and 27th November.
Nelson A. and P. Association · Richmond, 28th and 29th November.
Wyndham A. and P. Society: Wyndham, 5th December.
Southland A. and P. Association · Invercargill, 9th and 10th December.
Helensville A. and P. Association . Helensville, 29th January, 1931.
Feilding A. and P. Association: Feilding, 3rd and 4th February.
Masterton A. and P. Association: Solway, 17th and 18th February.
Te Awamutu A. and P. Association Te Awamutu, 18th February.
Marton A. and P. Association . Marton, 25th February.
Auckland A. and P Association: Auckland, 26th, 27th, and 28th February.
Katikati A. and P. Association: Katikati, 3rd March.
Taranaki Agricultural Association: New Plymouth, 4th and 5th March.
Waikato Central Agricultural Association: Cambridge, 4th and 5th March.
King Country Central A. and P. Association: Te Kuiti, 12th March.
Mayfield A. and P. Association: Mayfield, 14th March.
Methven A. and P. Association: Methven, 28th March.
Oxford A. and P. Association: Oxford, 2nd April.

Wool-production. — The total production of wool in New Zealand for the season 1929–30 is estimated at approximately 250,000,000 lb., as compared with 239,000,000 lb. for 1928–29.

ANNUAL SHEEP RETURNS AS AT 30TH APRIL, 1930.

TABLE I.—SUMMARY BY SHEEP DISTRICTS.

Class.	Auckland.	Napier-Gisborne	Wellington-West Coast.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago (including Southland).	Total in Dominion.
Stud rams entered (in flock-book)	1,282	1,198	3,521	834	3,536	3,877	14,248
Other rams	47,069	100,660	89,028	19,010	88,150	89,852	434,369
Wethers	464,012	656,259	723,766	243,293	561,665	718,921	3,367,916
Breeding-ewes	1,865,690	3,858,525	3,588,246	809,400	3,663,071	3,779,243	17,564,175
Dry ewes	86,094	281,071	203,781	57,836	231,375	217,515	1,077,672
Lambs	861,125	2,039,842	1,664,744	395,543	1,504,245	1,917,408	8,382,907
Totals, 1930 ..	3,325,272	6,937,555	6,273,086	1,526,516	6,052,042	6,726,816	30,841,287
Totals, 1929 ..	2,734,171	6,795,339	6,058,934	1,456,952	5,827,573	6,178,413	29,051,382

TABLE II.—COMPARATIVE STATEMENT: TEN YEARS, 1921–30.

Year.	Stud and Flock Rams.	Stud Breeding-ewes.	Stud Dry Ewes.	Stud Lambs	Total Stud Sheep and Flock Rams.	Sheep of Distinctive Breed not entered in Flock-books, and Crossbred Sheep.				Grand Total, Stud and other Sheep.
						Wethers	Breeding-ewes.	Dry Ewes.	Lambs.	
1921	322,144	158,608	9,513	110,428	600,693	3,634,799	11,989,180	1,336,306	5,724,053	23,285,031
1922	322,072	154,277	7,259	98,221	581,829	2,727,624	12,341,777	952,789	5,618,240	22,222,259
1923	330,055	172,843	9,013	119,749	631,660	2,551,627	12,890,160	808,919	6,199,073	23,081,439
1924	332,814	179,533	9,727	132,137	654,211	2,807,832	12,896,561	1,036,723	6,381,249	23,775,776
1925	355,579	184,744	7,867	131,485	679,675	3,063,663	13,530,479	875,899	6,398,239	24,547,955
1926	370,535	192,055	10,053	138,526	711,169	3,212,435	13,756,197	1,069,682	6,155,510	24,904,993
1927	388,274	199,219	8,644	144,897	741,034	3,074,974	14,632,511	823,047	6,377,450	25,649,016
1928	396,351	205,720	7,347	145,969	755,387	3,024,647	15,328,331	861,780	7,163,653	27,133,810
1929	422,331	219,802	7,203	156,526	805,862	3,289,135	16,388,353	875,495	7,692,537	29,051,382
1930	448,617	244,480	7,884	174,862	875,843	3,367,916	17,319,695	1,069,788	8,208,045	30,841,287

TABLE III.—DISTRIBUTION OF THE VARIOUS BREEDS, AND OF CROSSBREDS, IN EACH SHEEP DISTRICT (1930).

Breed.	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Total in North Island.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago.	Total in South Island.	Total in Dominion
Stud sheep (entered in flock-book)—									
Merino	21	17	..	38	7,467	13,148	7,690	28,305	28,343
Lincoln	666	1,175	6,208	8,049	366	183	347	896	8,945
Romney .	21,123	18,145	90,881	130,149	11,179	5,999	53,302	70,480	200,629
Border Leicester . .	1,030	..	381	1,411	323	13,453	10,826	24,602	26,013
English Leicester ..	2 796	244	225	3,265	1,844	21,363	987	24,194	27,459
Shropshire	373	..	306	679	61	2,853	999	3,913	4,592
Southdown .. .	5,811	12,865	38,919	57,595	1,627	19,020	3,082	23,729	81,324
Corriedale	538	134	1,030	1,702	1,067	39,175	13,454	53,696	55,398
Ryeland	1,076	696	592	2,364	33	1,291	196	1,520	3,884
Other breeds	300	..	68	368	1,517	2,555	447	4,519	4,887
Totals	33,734	33,276	138,610	205,620	25,484	119,040	91,330	235,854	441,474
Sheep of a distinctive breed, but not entered in flock-book—									
Merino	12,556	12,275	19,109	43,940	211,900	495,871	408,560	1,116,331	1,160,271
Lincoln	7,660	32,864	16,818	57,342	9,258	7,103	5,005	21,366	78,708
Romney .. .	441,412	1,486,236	1,037,547	2,965,195	147,591	103,017	413,486	664,004	3,629,289
Border Leicester .. .	5,358	4,399	1,811	11,568	1,016	23,599	24,518	49,133	60,701
English Leicester .. .	4,399	1,526	188	6,113	9,168	37,560	6,515	53,243	59,356
Shropshire	2,197	291	1,417	3,905	2,425	6,758	3,224	12,407	16,312
Southdown	14,946	29,006	58,281	102,233	1,873	23,204	12,151	37,228	139,461
Corriedale	3,710	24,710	18,852	47,272	34,706	678,003	434,934	1,147,643	1,194,915
Half-bred .. .	6,386	1,097	2,059	9,542	266,090	721,082	341,708	1,328,880	1,338,422
Ryeland	605	414	288	1,307	1,993	2,000	235	4,228	5,535
Other breeds	1,246	1,103	1,541	3,890	9,139	13,519	30,308	52,966	56,856
Totals	500,475	1,593,921	1,157,911	3,252,307	695,159	2,111,716	1,680,644	4,487,519	7,739,826
Crossbreds and others not otherwise enumerated	2,791,063	5,310,358	4,976,565	13,077,986	805,873	3,821,286	4,954,842	9,582,001	22,659,987
Grand totals ..	3,325,272	6,937,555	6,273,086	16,535,913	1,526,516	6,052,042	6,726,816	14,305,374	30,841,287

WEATHER RECORDS: SEPTEMBER, 1930.

Dominion Meteorological Office.

AFTER a severe winter August appeared to give promise of a return to milder conditions. September, however, brought a set-back, and another cold and stormy month was experienced. The tendency for subnormal temperatures which has been in evidence for over a year past therefore continues. The cold spell between the 6th and the 12th was responsible for considerable losses of lambs, especially in Hawke's Bay, the Wairarapa, and Canterbury. In the ranges of the South Island the snowfalls generally were not very heavy, so that the losses were not so serious as on the lower country where the effect of the cold was increased by the high precipitation. The growth of vegetation was retarded and the season is in a somewhat backward state. Nevertheless, stock, crops, and pastures are reported as mainly in fair condition.

Temperature. At Wellington and Christchurch last month was the coldest September recorded, while at many other places the only one with a lower mean temperature was that of 1925.

Rainfall: This was above normal in the district from Whangarei southwards to Auckland and Thames, in the eastern portion of the North Island from East Cape to Wellington, and on the high Central Plateau, and in Canterbury and Otago. Elsewhere, it mainly was below normal. The excesses were considerable in parts of Hawke's Bay, Canterbury, and North Otago. In most districts where a deficit was recorded it was of a considerable magnitude also, while the areas round Nelson and Blenheim had a very dry month.

Pressure: The mean pressure was considerably below the September average.

Sunshine and cloudiness: The month was a cloudy one in most districts, and the total amount of sunshine recorded was unusually low.

Winds: The month, on the whole, was a windy one, especially in the northern half of the North Island and in eastern districts generally. There was a persistent tendency for low pressures to the east of New Zealand, while over eastern Australia high pressures prevailed. The result was that once more there was a high proportion of southerly winds. During the period from the 23rd to the 28th weather of the westerly type ruled and conditions were mild.

Weather and storm systems: In many parts the month was a showery one, with the rainfall fairly uniformly distributed. No very general rains were experienced, and such heavy falls as were recorded came at different periods in the different districts.

The month began with a series of small and irregular depressions operating over the Dominion. By the 4th these had moved off to the eastward, where they increased in depth. This condition persisted practically continuously until the 12th, there being only slight fluctuations, due to pressure waves moving from the westward. Strong southerly winds prevailed and gale force was experienced at times in many places. The 7th was a particularly unpleasant day, snow being very widespread on the high country of both Islands and extending to the low levels in the South Island. Snow and hail were, indeed, of frequent occurrence in some part or other of the Dominion throughout this period. On the 10th Gisborne had its first fall of snow for many years. Precipitation was heavy in Canterbury and Otago, and there were considerable losses of lambs.

During the 14th and 15th a rather deep depression moved past the Dominion from the westward, its centre crossing Foveaux Strait. On the 16th a cyclone developed in the northward extension of this depression

RAINFALL FOR SEPTEMBER, 1930, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.
	North Island				
		Inches.		Inches.	Inches.
1	Kaitaia	4·57	21	0·65	5·25
2	Russell	2·94	18	0·53	4·19
3	Whangarei	5·40	23	1·30	4·96
4	Auckland .. .	4·71	25	0·65	3·68
5	Hamilton	3·34	18	0·59	4·41
5A	Rotorua	2·80	11	0·74	5·17
6	Kawhia	3·57	17	0·79	4·58
7	New Plymouth	4·02	18	0·65	5·40
8	Riversdale, Inglewood ..	6·68	21	1·21	9·77
9	Whangamomona	5·64	14	1·45	7·32
10	Eltham	4·64	15	0·79	4·55
11	Tairua	5·00	17	1·47	4·75
12	Tauranga	3·00	19	1·11	4·43
13	Maraehako Station, Opotiki	3·60	16	1·24	4·26
14	Gisborne	3·59	18	0·63	2·95
15	Taupo	2·38	13	0·60	3·94
16	Napier	3·62	13	0·96	2·17
17	Hastings	3·10	16	0·76	2·57
18	Taihape	3·93	20	0·70	3·16
19	Masterton . ..	3·11	18	0·53	3·05
20	Patea	2·57	19	0·48	3·64
21	Wanganui	1·72	10	0·35	2·93
22	Foxton	1·96	8	1·46	2·47
23	Wellington (Karori Reservoir)	5·55	20	1·52	3·52
	South Island.				
24	Westport	5·52	11	1·60	8·30
25	Greymouth	7·22	14	2·20	8·15
26	Hokitika	8·03	16	2·14	9·33
27	Ross	10·77	14	2·08	13·23
28	Arthur's Pass	12·85	8	3·74	15·91
29	Okuru	..	..	..	12·60
30	Collingwood	..	..	..	9·77
31	Nelson	1·49	7	0·42	3·76
32	Spring Creek	0·80	7	0·30	2·77
33	Tophouse	3·77	12	0·95	5·95
34	Hanmer Springs	4·67	16	1·25	4·10
35	Highfield, Waiau	2·52	11	1·02	3·02
36	Gore Bay	3·30	9	2·24	3·01
37	Christchurch	2·24	14	0·45	1·73
38	Timaru	2·02	14	0·90	1·93
39	Lambrook Station, Fairlie ..	3·16	12	0·86	2·19
40	Benmore Station, Clearburn	2·41	14	0·44	2·14
41	Oamaru	2·78	14	0·80	1·65
42	Queenstown	2·69	15	0·42	2·55
43	Clyde	1·23	11	0·49	1·04
44	Dunedin	3·98	18	0·72	2·76
45	Wendon	2·47	16	0·35	2·56
46	Gore	..	..	..	2·84
47	Invercargill	2·78	20	0·46	3·28
48	Puysegur Point	8·60	25	1·73	6·60
49	Half-moon Bay	3·19	19	0·65	5·45

and crossed the Auckland Peninsula during the night. Between the 14th and 17th rain was experienced in practically all parts of the country. The eastern districts of the North Island recorded heavy falls on the 16th and 17th.

The last-mentioned storm passed away gradually, and from the 23rd to the 29th a series of depressions of the westerly type followed one another across the Tasman Sea and New Zealand. It was during this interval that the west coast of the South Island received most of its rainfall for the month. The mild temperatures brought by the westerlies were a very welcome change. The last of this series of depressions passed on the 29th, and was followed by severe southerly gales which continued until the 1st October. In the North Island and Nelson the 29th was a very bitter day with frequent hailstorms, but on the east coast the 30th and 1st October were more severe. In addition to the widespread hailstorms there were heavy snowfalls on the ranges.

—*Edward Kidson, Director of Meteorological Services, Wellington, 7/10/30.*

CERTIFICATION OF SEED POTATOES.

CERTIFICATES ISSUED ON FINAL TUBER INSPECTION, SEPTEMBER, 1930

Aucklander Short-top (N.Z. Sutton's Supreme).

Weeber Bros, Belfast.
F. Brundell, Camside, Kaiapoi.
J. Jellie, Russley Road, Fendalton.
W. E. Martin, R.M.D., East Eyreton
G. Harris, Milford, Temuka
A. J. Rich, R.M.D., Kaiapoi.
W. Oakley, R.M.D., Halkett.
D. Marshall, R.M.D., Killinchy
F. C. Herridge, Woodend
J. Rouse, Pareora, via Timaru
R. Barnett, Dunsandel.
T. O'Brien, St Andrews
A. D. Carroll, R.M.D., Southbridge
C. Redmond, R.M.D., Kimberley.
C. H. Jordan, R.M.D., Kaiapoi
M. Breen, Levels.
Muff Bros, Orari.

Aucklander Tall-top (N.Z. Sutton's Supreme).

Weeber Bros., Belfast.
H. S. Moore, Box 4, Kaiapoi.
J. Warren, Russley Road, Fendalton.
J. Bailey, R.M.D., Kaiapoi.

Epicure.

D. Marshall, R.M.D., Killinchy.
G. McLachlan, R.M.D., Southbridge.
W. Shellock, R.M.D., Mead, Rakaia

Dakota.

H. M. Marshall, R.M.D., Weedons.
W. A. McPhail, Rakaia.
W. Gee, Springlands, Blenheim.
W. J. Crozier, Mitcham, Rakaia.
E. Hinton, Templeton.
R. Hewson, Seadown, Timaru
A. J. Breakwell, Tinwald, Ashburton.
S. Cross, R.M.D., Rolleston
C. E. Walker, R.M.D., West Melton.
Munro and Scarth, Lavington, Rakaia.

Dakota—continued.

J. H. Doak, Barr Hill, Rakaia.
J. Curragh, Templeton.
P. J. Thornton, Harewood, Christchurch.

Robin Adair

D. Marshall, R.M.D., Killinchy.

Majestic

A. J. Clark, Box 34, Rangiora.
C. H. Wilson, Lorneville, Invercargill.

Arran Chief.

G. Jones, "Vale Royal," Halswell.

Early Regent.

M. Kelly, 502 Lincoln Road, Halswell.
Jas Curragh, Templeton.

King Edward.

L. King, Glencoe, R.D., Invercargill.
A. Anderson, Stirling.
J. McLeary, Mataura Island.
O. S. Mosley, Stirling.
A. H. Rose, Glencoe, R.M.D., Invercargill.
C. E. Knowler, Tuatapere.
R. M. King, Tuatapere.
W. E. Brown, Orepuki.

Iron Duke.

H. A. Hancock, Awahuri, Palmerston North.

Golden Wonder

J. Warren, Russley Road, Fendalton.

Up to Date.

H. D. Norman, Tuatapere.
C. E. Walker, R.M.D., West Melton.

Bresee's Prolific.

D. Marshall, R.M.D., Killinchy.

NOTE.—The above will be the last list applying to the 1929–30 crop. See also lists published in the *Journal* for May, July, August, and September. The May list (provisional certificates) gave the acreage and relative cropping-power of each line.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

EFFECTS OF DEHORNING ON DAIRY CATTLE.

"Dairy-farmer," Manutuke :—

I have heard the opinion expressed that cows dehorned as calves do not produce the same amount of butterfat as horned cows, also that a dehorned bull calf will not be a good sire. I would be glad to know if you have any definite experiences in this matter.

The Live-stock Division :—

Our experience in this direction has been gleaned from farmers who have dehorned for many years, and we have not heard any of them complain that such a practice was detrimental. In fact, those who have carried out the practice long enough to obtain results speak highly of it, in as much as the herds settle down better and are more easily handled. With reference to dehorning bull calves, most of the sires used in dairy herds are pedigrees, and these as a rule are not dehorned. This being so, there have not been the same facilities for making observations. However, we fail to see how dehorning a bull calf could have any ill effects later on his progeny

CHECKING GROWTH OF LICHENS ON EVERGREEN TREES.

G. W. Paul, Wanganui :—

We have a number of evergreen trees which through their shady situation are becoming infested with lichens Could you recommend a method of removing these unsightly growths?

The Horticulture Division :—

For checking the growth of lichens on evergreen trees growing in a shady position a treatment that would most likely be effective at the present time would be a Burgundy spray mixture composed of 4 lb. bluestone, 5 lb washing-soda, and 40 gallons water, repeating the application after two to three weeks Dissolve the bluestone with hot water, then dilute it up to 35 gallons in a wooden vessel; dissolve the soda, and dilute it to 5 gallons. Pour the soda solution slowly into the bluestone solution, stirring well meanwhile It should be applied as a fine spray without delay, as it will otherwise lose its fine adhesive properties which make it effective for a considerable period.

ROOT FUNGUS IN LUCERNE.

"Subscriber." Whakamara, Hawera :—

Kindly advise me if there is any cure or prevention for root-fungus in lucerne. I am thinking of putting some in this year I had a paddock of lucerne a few years ago, and it was as nice a crop as you would wish to see, but the root-fungus got into it and practically wiped the whole lot out It has been very heavy timber country here, and I am wondering if that has anything to do with it. The fungus does not seem to attack the lucerne until it is two or three years old.

The Fields Division :—

The fungus you refer to is known as rhizoctonia, and there is reason to believe that the organism is identical with *Rhizoctonia violacea*, which is found on a large variety of plants. As the name indicates, rotting takes place, resulting in the yellowing and ultimate death of the foliage. The disease tends to occur in circular patches, which generally extend their area. It is almost impossible

to control rhizoctonia, on account of the wide range of its host plants, as well as the fact that sclerotia are formed which can remain dormant in the soil for fairly lengthy periods. The fact that your lucerne patch was on country that was previously heavily timbered would not account for the occurrence of the disease, but it might possibly occur, for instance, after a crop of mangels badly affected with what is commonly called black fungus or rhizoctonia. Should you have a repetition of the trouble in your new lucerne you would be well advised not to continue cultivation of the stand, as it is easily spread by such means over the whole area. Diseased patches should be well manured and allowed to take their chance with weeds, rather than spread the trouble over the whole field.

IODIDE OF POTASSIUM IN STOCK-LICK.

H. F. HURSTHOUSE, Blenheim :—

In the September *Journal* there is a recipe for mixing licks for stock, one of the ingredients being 3 oz. iodide of potassium, to be dissolved and sprayed over 100 lb. salt, &c. Is it not a fact that potassium iodide evaporates rapidly? If this is so, then it seems that the greater portion of the iodide will have evaporated before the stock can get the lick.

The Live-stock Division :—

Although evaporation occurs in the case of iodine itself, potassium iodide does not evaporate. No apprehension need, therefore, be entertained on the point of loss of iodine in the lick.

NOTE.—" Invercargill Inquirer," who asks for advice regarding the blueberry, should supply name and postal address in order to obtain an answer.

KILLINGS AT MEAT-EXPORT WORKS.

THE following table, compiled from Meat Producers Board statistics, gives particulars of aggregate killings and/or equivalent output at meat-export works in New Zealand for the past five years ended 30th September. The total weight of output in 1929–30 creates a high-level record for the industry.

Year ended 30th September,	Beef Quarters.	Mutton Carcasses.	Lamb Carcasses.	Pork Carcasses.	Boned Beef =Freight Carcasses.	Frozen Sundries =Freight Carcasses.	Total Equivalent in 60 lb. Freight Carcasses.
1925–26	215,594	2,001,340	5,000,590	60,757	223,415	111,229	5,610,730
1926–27	184,331	2,094,354	5,381,121	74,633	242,044	69,534	5,956,708
1927–28	394,821	2,005,333	5,947,197	147,601	283,749	125,200	6,998,086
1928–29	151,115	1,751,979	5,971,557	159,297	161,597	153,331	6,152,695
1929–30	177,379	2,621,275	6,925,859	133,591	194,311	229,673	7,506,227

BOOKS RECEIVED.

THE ENGLISH PLOUGH, by J. B. Passmore, M.Sc., Lecturer in Agricultural Machinery, University of Reading. Oxford University Press, London: Humphrey Milford. Price 7s. 6d. net.

BELTED GALLOWAYS, by Sir Ian Hamilton, Vinton and Co., Ltd., London. Price 2s. net.

CROP PRODUCTION AND MANAGEMENT, by Joseph F. Cox, Dean of Agriculture, Michigan State College and Experiment Station. Second edition, revised. John Wiley and Sons, Inc., New York; Chapman and Hall, Ltd., London. English price 13s. 6d. net.

ROTHAMSTED EXPERIMENTAL STATION REPORT FOR 1929. Lawes Agricultural Trust, Harpenden, England. Price 2s. 6d.

The New Zealand

Journal of Agriculture.

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CROP CERTIFICATION.

NOTES ON OPERATIONS IN 1929–30 SEASON AND CURRENT DEVELOPMENTS.

J. W. HADFIELD, Agronomist, Plant Research Station, Palmerston North.

DURING the past three years a number of articles have been published in the *Journal* relative to the crop-certification system established by the Department of Agriculture, and to the different branches of the work. Readers will therefore be fairly familiar with the subject, and it will not be necessary to make introductory explanations on the present occasion. The object of this article is to briefly summarize the various certification activities for the season of 1929–30, touching also some consequential points connected with current season's affairs. The accompanying photos, illustrating different stages of rye-grass certification work, will doubtless prove of additional interest to farmers and to others connected with the seed trade.

Seed Wheat.

The demand for certified seed wheat has again exceeded expectations. There has been steady progress in this branch, as indicated by the following figures :—

Table 1.

Season.	Area inspected.	Area passed in the Field.	Quantity purchased and resold after Machine-dressing.	Value.
	Acres.	Acres.	Bushels.	£
1927–28	347	216	3,840	1,439
1928–29	1,856	700	11,682	3,934
1929–30	2,779	640	13,050	4,558

In addition to the figures quoted for the 1929–30 season one firm grew and reta ned for its own sale 3,664 bushels of certified smut-free seed, comprising six varieties. This seed was not purchased by the Department, and therefore does not appear in the returns, but it brings up the total amount certified to 16,714 bushels.

It has been agreed to alter the organization for the 1930–31 season. There will be the usual field and grain inspection, but the Department will not in future purchase and distribute certified seed wheat. Samples and full details of every certified line will be distributed to merchants for their information, and the amount passed will be limited to the probable demand for seed of the several varieties. There will then be an open market, and growers will be in a position to sell where they like, and merchants to select the lines they wish to buy from the samples sent them.

A determined effort will be made to distribute as widely as possible those lines that are smut-free, and such lines will be specially marked. Finally, only those crops will be inspected which originate from certified seed.

Wheat-certification is undertaken in co-operation with the Wheat Research Institute, Christchurch. The Department of Agriculture undertakes all field-work, and the Institute arranges grading and distribution of samples.

Full particulars of the wheat-certification system will be found in the *Journal* for April, 1928.

Potatoes.

A total of 408 applications from potato-growers for certification trial were received during 1929–30, as compared with 180 in the previous season. Applications so far received for the present season indicate another advance, in spite of the fact that owing to the necessity for strict economy applications are now restricted to those lines originating from crops provisionally certified either last season or the season before. Any other lines are allowed entry in the qualification trials, and should they prove of sufficiently high standard they may be entered for certification the following season.

The following figures giving the numbers of entries show the progress that has been made in the last four years: 1927–28, 137 crops; 1928–29, 180 crops; 1929–30, 408 crops; 1930–31, 617 crops (355 for certification trial, 262 for qualification trial).

A full report of the 1929-30 season's operations appeared in the August issue of the *Journal*.

Perennial Rye-grass Seed.

The season of 1929–30 was the first in this branch of certification. The bulk of the seed originated from Hawke's Bay, some from Poverty Bay, and two crops of first harvest seed from Central Otago.

A total of 171 crops were passed in the field, representing 2,297 acres. The 6,111 sacks containing the produce of these areas were branded and sealed in the paddock during threshing. Of this, 851 sacks were sold undressed and 5,260 were received by merchants for machine-dressing, from which 17,052 bushels of machine-dressed seed were obtained.

The figures for Hawke's Bay and Poverty Bay are set out in Table 2, the seed being the produce of pasture five years old or over.

The combined effect of certification and other factors caused a sharp rise in the price of certified perennial rye-grass machine-dressed

FIG 1 FIELD INSPECTION OF A PERENNIAL RYE-GRASS AREA

[*Photo by E. Bruce Levy.*

FIG. 2. THRESHING CERTIFIED RYE-GRASS SEED.

The sacks are branded and sealed in the paddock as the seed comes from the mill The brand enables the line of seed to be identified at the dressing-station, and seals prevent substitution.

[*Photo by H. Drake.*

FIG. 3 DRAWING A SAMPLE OF RYE-GRASS SEED IN THE FIELD.

This sample is for trial at the Plant Research Station, where it is sown to determine purity of strain These trials afford an early check on the accuracy of field inspection.

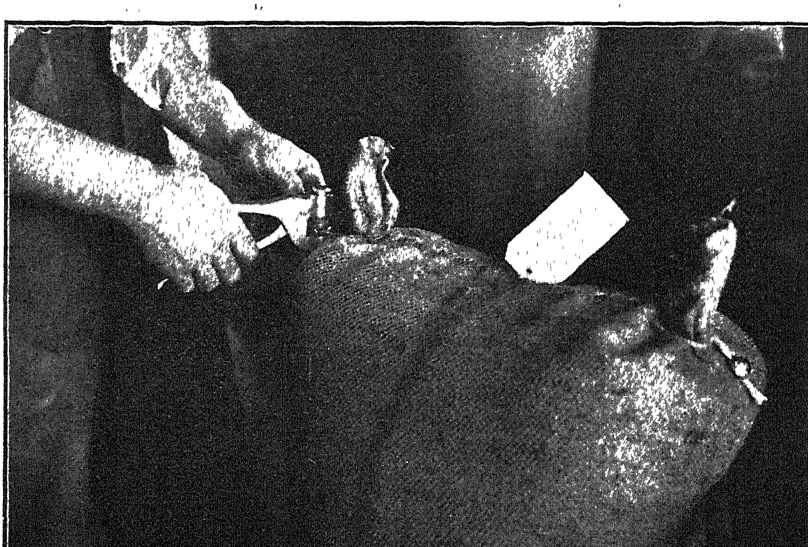

FIG. 4. SEALING AFTER MACHINE DRESSING.

A careful check is made of the weight of seed in and out of the machines during dressing. An insert slip is placed inside the sack, and the seaming twine is threaded through the outside tag during the sewing of the sack. Finally, the ends of the seaming twine are sealed with metal seals at both lugs.

[*Photos by H. Drake.*

Table 2.

District.	Seed sealed in Paddock	Machine-dressing.			Average Yield per Acre of Un-dressed Seed.	Average Yield per Acre of Machine-dressed Seed.	Government Statistician: Average Yield per Acre not Machine-dressed.	
		Into Machine	Out of Machine.	Percent-age of Loss in Dressing.			1927–28.	1928–29.
	Bushels	Bushels.	Bushels		Bushels.	Bushels.	Bushels.	Bushels.
Hawke's Bay..	34,365	30,405	15,754	48	16·80	8·70	24·15	17·00
Poverty Bay ..	1,925	1,267	736	42	8·70	5·05	6·35	12·25

seed to round about 18s. to 20s. per bushel. This price is considered by graziers to be prohibitive, and in view of the urgent necessity for abundant supplies at reasonable prices growers in seed-producing districts have been encouraged to purchase certified seed, sow this, and enter their crops for certification. It is therefore interesting to note the distribution (up to date of writing) of the seed certified last season, as follows:—

District.	Sacks of Machine-dressed Seed.	Sacks of Undressed Seed.
Auckland	397	96
Poverty Bay	16	29
Hawke's Bay	269	352
Taranaki	446	5
Wanganui	161	3
Palmerston North	245	7
Wairarapa	45	..
Wellington	250	43
Marlborough	79	15
North Canterbury	48	..
Mid-Canterbury	23	..
South Canterbury	41	..
Otago	23	.
Southland	4	..
Totals..	2,047	550

A large proportion of the 250 sacks sent to Wellington has been redistributed to the South Island, but these returns are not yet available. One would be safe in assuming that 2,500 to 3,000 bushels have reached the South Island—enough to sow down between 1,600 to 2,000 acres. In addition to this a proportion of the seed distributed in the North Island is being sown for further seed-production.

Nothing very definite will be known about new areas entering for certification till December, but indications are very promising.

Brown-top Seed.

During the past few years the export of brown-top seed has increased very considerably, and the trade has become sufficiently important to warrant steps being taken to make available seed certified free from red-top. There has been no scarcity of areas and therefore of seed to fill export requirements, and thus there is every reason for harvesting only those free from red-top. Many of the overseas buyers were demanding a guarantee to this effect, and therefore the project met with the ready co-operation of merchants.

Unfortunately, the United States created a tariff duty of 40 cents per pound on all imported brown-top seed. News of this arrived at a time which just enabled merchants to ship a portion of the harvest to land before the tariff became operative. Dressing-stations worked day and night to get away as much seed as possible, and the Department's officers in Otago and Southland found it impossible to cope with the demands for their services. Merchants preferred to ship without the necessary tagging and sealing rather than have seed left on their hands.

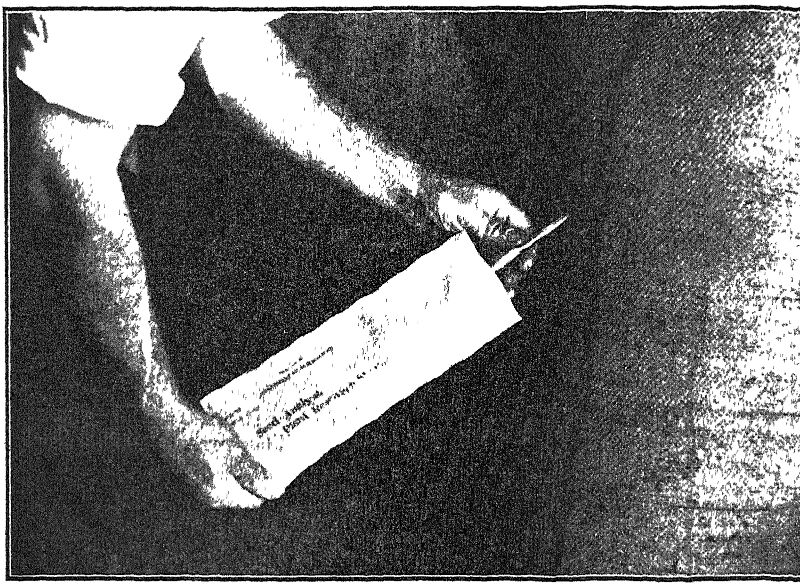

FIG. 5. SAMPLING SEED FOR PURITY AND GERMINATION ANALYSIS.

The final operation consists in drawing a representative sample from each sack in the line. This sample is forwarded to the Plant Research Station for purity and germination analysis, and a certificate is issued to the holder of the seed.

[*Photo by I. Drake.*

Nevertheless the officers concerned coped very effectively with these difficulties and inspected 178 areas, of which 154 were passed. This represents an area of approximately 22,000 acres declared free from red-top, and the bulk of the produce from this area was branded in the field and eventually machine-dressed, and tagged and sealed for export. Actually 168,958 lb., or over 75 tons, of machine-dressed seed was sealed. Several lots of certified seed harvested in South Canterbury were sent to Dunedin for machine-dressing. This brings the total to 170,071 lb., or approximately 76 tons.

Any estimate of the yield per acre computed from these figures is very misleading, and works out at under 10 lb. per acre. The position is that although an area of 15,486 acres in Southland and Otago declared free from red-top produced 153,379 lb. of seed, only the heavier-seeded and more accessible areas would be stripped. There-

is a considerable loss in the machine-dressing of brown-top seed. Thus 48,132 lb. from Otago lost 16,832 lb., equivalent to 35 per cent.; and 78,418 lb. from Southland lost 29,789 lb., or 37 per cent.

White Clover.

The certification of old-pasture white clover was commenced in a more or less experimental way during the season 1928–29. Operations were somewhat more extensive during 1929–30, 734 acres having been passed and harvested. The seed from 664 acres was machine-dressed, with the following results: Into machine, 89,691 lb.; out of machine, 60,747 lb.; loss, 28,944 lb.; percentage of loss, 32·38 lb.; yield per acre of machine-dressed seed, 91·5 lb.; yield per acre of undressed seed, 135 lb.

There was also 11,561 lb. of seed carried over from 1928–29 which was machine-dressed last season, yielding 10,595 lb. of dressed seed. In addition some seed was also machine-dressed out of old-pasture rye-grass, yielding 8,268 lb. The total amount handled in the 1929–30 season was therefore 79,610 lb., or approximately 35½ tons.

The basis for certification has been one of age, the standard being that the pasture must be five years old or over. Seed harvested from these pastures may be said to be superior to the average, eliminating as it does most of the short-lived Dutch types. Nevertheless the term "old pasture" does not imply any particular strain, and will be replaced as soon as possible by a standard based on strain.

According to trials undertaken by the Agrostologist to this Station, a very excellent strain of white clover exists in New Zealand in sufficient quantities to warrant certification. The presence of this strain is probably responsible for the popularity of our clover in Britain, and if it were possible to isolate this a very satisfactory export trade might eventuate. Steps are therefore being taken to locate as many areas as possible producing this type, and the certification of this as "N.Z. Wild White" will probably replace the certification of "Old Pasture White" in the 1931–32 season.

The certification outlined has been carried out by officers of the Fields Division, Department of Agriculture, who deserve great credit for the volume and accuracy of the work they have achieved. The writer is indebted to Mr. J. H. Claridge, Assistant in Agronomy, for help in taking out and tabulating the figures quoted in this review.

Casein for Export.—The quantity of casein graded by the Dairy Division during the year ended 31st March last totalled 2,040 tons, being 150 tons in excess of the total for the previous year. The major portion of the casein graded—90 per cent.—consisted of the lactic variety, the balance of 10 per cent. being rennet casein. Quality was of a uniformly high standard, and the product is considered equal to the best offering on overseas markets. A charge of 1½d. per hundredweight for grading casein was in operation during the whole year, and although this service is optional to the exporter the greater part of the output was graded prior to shipment.

IODINE CONTENT OF LAMB THYROIDS.

NEW ZEALAND ANALYSES COVERING TWELVE-MONTH PERIOD.

B. W. SIMPSON, Rowett Research Institute, Scotland. (On loan to Chemistry Section, New Zealand Department of Agriculture.)

ACCORDING to Orr and Leitch (" Iodine in Nutrition," 1929), the most important factor affecting the iodine content of the thyroid gland is the iodine content of the food or the intake of the animal. This overshadows differences due to species, age, or sex.

Kendall (*Journal of Biological Chemistry*, LXXX, No. 2, Dec., 1928) found a 300-per-cent. variation in the iodine content of thyroid glands throughout the year. Seidell and Fenger, working on American sheep, also found a seasonal variation (*Journal of Biological Chemistry*, XIII). Martin, working on English sheep, found only a variation of 0·10 to 0·13 per cent. fresh weight (*British and Colonial Druggist*, LXII). McCarrison has also shown that there is a seasonal prevalence of goitre in humans.

Lowe (*Quarterly Journal of Microscopical Science*, Feb., 1930) states that in all young animals the thyroid gland goes through alternate periods of activity and rest, and these changes are correlated with the season. A colloid condition of the gland prevails during the autumn and early winter months, this being replaced by a more active condition which continues till the beginning of the summer, when it gives way once more to the colloid condition. In older animals Lowe states that there are no such obvious seasonal changes, the colloid state being most commonly present. In aged animals Lowe found the colloid condition to be the rule, and the glands did not appear to respond to sexual or seasonal influences.

According to Lowe, the average weight of the gland in young male sheep is 2·34 grammes and in females 1·98 grammes in autumn and winter, and in spring the average is 2·96 grammes. In summer female lambs had thyroids weighing 2·43 grammes, males 2·37 grammes, yearling males 3·8 grammes, and yearling females 2·6 grammes. Another factor which influences the glands of females at least, besides iodine intake and seasonal variation, is temperature. Generally speaking, the return to the colloid condition coincides with increase of temperature. (Mills, *American Journal of Physiology*, 46).

ANALYSES OF NEW ZEALAND SPECIMENS IN 1929–30.

The following tables give the iodine content of lambs' thyroids taken in this country between July, 1929, and June, 1930. These specimens were sent to the Department's chemical laboratory for analysis throughout the year and have been tabulated according to the date taken, so that thyroids from one area may be compared with those from another at the same time of the year. The maximum amount of iodine is said to be in the gland in the autumn and early winter. The minimum is said to be in the spring.

January, 1930.

Place and Description.	Date taken.	Weight of Gland.	Iodine Content	Percentage of Iodine.
		Grammes.	Grammes.	
Karamu, South Auckland ..	10/1/30	2·3	0·002	0·105
Wairarapa; weak lamb	9/1/30	1·3	0·002	0·127
Carterton	7/1/30	3·0	0·002	0·065
Marton	29/1/30	2·5	0·010	0·164
Waimea Plains, Nelson (10 miles from sea); ewe lamb	23/1/30	2·1	0·001	0·049
Gore (20 miles from sea) ..	23/1/30	2·32	0·0008	0·035
Otautau; four-months lamb ..	20/1/30	5·8	0·002	0·036
Ryal Bush, Southland; four-months lamb	22/1/30	3·2	0·002	0·060
Ditto	22/1/30	4·5	0·002	0·036
Pomahaka, Otago; four-months lamb	27/1/30	3·5	0·003	0·071
Tokonui, Southland; four-months lamb	27/1/30	3·5	0·001	0·035

The lamb from Wairarapa had a thyroid under the normal weight. Small glands seem to be the rule on lime-deficient areas. The Otautau, Ryal Bush, Pomahaka, and Tokonui lambs all have thyroids over the normal weight for their age and for this season. Lambs from those areas and from the Waimea Plains and from Gore would probably improve in condition and growth if fed additional iodine in the form of a drench or lick. Four grains of potassium iodide a week is the optimum dose.

February.

Place and Description.	Date taken.	Weight of Gland.	Iodine Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Kaikohe, North Auckland; seven-months lamb	28/2/30	2·9	0·0035	0·121
Herekino, North Auckland; six-months lamb	7/2/30	2·8	0·0021	0·075
Ashburton: five-months lamb ..	12/2/30	4·2	0·001	0·028
Valetta, South Canterbury ..	1/2/30	3·3	0·001	0·037
Lincoln; one year	3/2/30	4·9	0·004	0·080
Murchison; wether lamb ..	6/2/30	2·75	0·0017	0·063
Bishopdale, Nelson, ewe lamb ..	6/2/30	3·30	0·0038	0·115
Stoke; ewe lamb	6/2/30	3·20	0·0012	0·039
Murchison (Hunter's Station) ..	6/2/30	2·21	0·0007	0·033
Richmond, Nelson	12/2/30	4·15	0·0007	0·017
Motueka, Nelson; river-flat ..	12/2/30	2·70	0·0015	0·055
Owen..	12/2/30	3·15	0·0005	0·017
Owen Junction	12/2/30	3·25	0·0009	0·029
Invercargill	18/2/30	1·9	0·001	0·073
Ahaura, Westland	13/2/30	44·9	0·0026	0·006
,, ,, ...	13/2/30	24·7	0·0043	0·018
,, ,, ...	13/2/30	20·8	0·0056	0·027

Compared with the Kaikohe and Bishopdale lambs' thyroids all the others are low in iodine. The thyroids from Ashburton, Richmond, Owen, and Ahaura all have below the critical percentage—

0·03 of iodine. Below this percentage the thyroid gland functions imperfectly. The Ahaura glands are extremely deficient in iodine.

March.

Place and Description.	Date taken	Weight of Gland.	Iodine Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Pakaraka, North Auckland; seven-months lamb	10/3/30	2·9	0·0026	0·088
Pohangina, Wellington; eight to nine months	7/3/30	3·5	0·0008	0·024
Weedon's, Canterbury, six months	6/3/30	2·7	0·0009	0·035
Ross, Westland; six months ..	12/3/30	24·3	0·004	0·017
,, ,, ,, ..	12/3/30	13·0	0·001	0·011
,, ,, ,, ..	12/3/30	4·8	0·001	0·030
,, ,, ,, ..	12/3/30	6·0	0·002	0·025

The lambs' thyroids from Ross and Palmerston North are all deficient in iodine. The Canterbury lambs' thyroids are very low, and this at the time of the year when glands have the maximum amount of iodine.

April.

Place and Description.	Date taken.	Weight of Gland	Iodine Content.	Percentage of Iodine
		Grammes.	Grammes.	
Lincoln; one-year lamb ..	8/4/30	4·2	0·003	0·069
Methven, Canterbury, seven months	29/4/30	10·8	0·0068	0·063
,, ,, ,,	29/4/30	6·4	0·0027	0·042
,, ,, ,,	29/4/30	3·3	0·0014	0·043
Ahaura, Westland; seven months	7/4/30	..	..	0·023

Methven lambs' thyroids are all over the normal as regards size, and, although not deficient in iodine, the content is low. The Ahaura lambs' thyroids are still deficient.

May.—No samples were sent for analysis during this month.

June

Place and Description.	Date taken.	Weight of Gland.	Iodine. Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Dunedin	2/6/30	166·85	0·013	0·008
Blenheim; "bowie" lamb, seven months old	7/6/30	0·55	0·0002	0·029
Blenheim; "bowie" lamb, ten months old	25/6/30	1·70	0·0007	0·057

The thyroids of the lambs suffering from "bent leg" ("bowie" lambs) are very small in size, and the iodine content is low. There

is obviously another mineral deficiency—probably lime—in this area. The first thyroid in the June list came from the Dunedin abattoir and is goitrous.

July, 1929.

Place and Description.	Date taken.	Weight of Gland.	Iodine Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Tai Tapu, Canterbury	1/7/29	3·0	0·0001	0·032

Nine glands were obtained from Tai Tapu in July. The average weight and iodine percentage of these are given. This is a reputed goitrous area. The iodine content of pasture and milk samples from this area is low. These glands received were normal, but verging on the critical iodine percentage (0·03 per cent.).

August.

Place and Description.	Date taken.	Weight of Gland.	Iodine Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Wairarapa; one to two months ..	7/8/29	3·6	0·005	0·0151
Wairarapa (Carterton); one to two months	14/8/29	3·0	0·0003	0·110

These glands are quite normal.

September.—No glands were received in this month.

October.

Place and Description.	Date taken.	Weight of Gland	Iodine Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Wanaka, Otago; newly born lambs	10/10/29	0·27	0·0002	0·0009
,, ,, ,,	10/10/29	3·2	0·0009	0·030
,, ,, ,,	10/10/29	10·8	0·0001	0·001
,, ,, ,,	10/10/29	60·9	0·0003	0·0005
Maniototo, Otago; newly born lambs	19/10/29	1·6	0·002	0·112
,, ,, ,,	23/10/29	1·3	0·002	0·153
,, ,, ,,	26/10/29	0·49	0·0003	0·050
,, ,, ,,	29/10/29	1·08	0·001	0·091
Otago; deformed fœtus ..	31/10/29	1·3	0·0003	0·019
Otago; newly born	31/10/29	0·86	0·0009	0·104
,, ,, ...	31/10/29	0·77	0·001	0·142
,, ,, ...	31/10/29	1·12	0·002	0·187
Otago; deformed fœtus ..	31/10/29	0·48	0·0004	0·076

The Wanaka lambs' thyroids are deficient in iodine, with one exception. Some of the Otago lambs' thyroids are extremely small in size and have a low iodine content. They resemble the Blenheim glands in this respect

November.

Place and Description.	Date taken.	Weight of Gland.	Iodine Content	Percentage of Iodine.
		Grammes.	Grammes.	
Wallaceville, Wellington ..	15/11/29	0·94	0·0006	0·061
Mangamahu, Wellington ..	29/11/29	0·80	0·0001	0·012
Taihape, Wellington ; three months old	13/11/29	2·04	0·001	0·048
Levin ; three months old ..	13/11/29	2·6	0·003	0·112
Maniototo, Otago	4/11/29	1·5	0·0003	0·210
,, ,, ...	4/11/29	1·7	0·002	0·125
,, ,, ...	4/11/29	1·7	0·002	0·140
,, ,, ...	4/11/29	1·97	0·001	0·123
,, ,, ...	5/11/29	1·2	0·0008	0·066
,, ,, ...	5/11/29	1·04	0·0018	0·169
,, ,, ...	5/11/29	1·02	0·0012	0·123
Otago ; deformed fœtus ..	9/11/29	1·5	0·003	0·167
Maniototo, Otago	9/11/29	0·99	..	..
,, ,, ...	9/11/29	0·93	0·001	0·119
,, ,, ...	9/11/29	1·61	0·001	0·090

The Mangamahu gland is extremely deficient, yet the gland is very small. The Taihape and Levin glands are interesting because they are exactly comparable as regards age and season.

December.—In this month twenty-seven glands were obtained from Wairarapa lambs. The average weight was 2·3 grammes, and the iodine percentage 0·03—on the verge of deficiency.

Conclusion.

The iodine content of the thyroids of lambs born and bred on definite areas seems to give a fair indication of the amount of iodine available on those areas. Systematic advisory work on iodine feeding to stock could be based on such analytical data. More data and more widespread investigations are, however, required.

TURNIP-MANURING IN CANTERBURY.

RECOMMENDATIONS TO GROWERS.

Fields Division, Department of Agriculture.

During the past six years turnip-manuring experiments to test the effect of various manures on field germination and yield have been conducted in Canterbury. The results of all experiments will be published in a subsequent issue of the *Journal.* The present brief article is intended only to indicate the salient features of the trials and provide recommendations to growers for the coming sowing season. For a fuller explanation of the work already conducted and in progress readers are referred to the *Journal* for October, 1928, page 245.

Superphosphate.

Every farmer knows that in almost all cases some form of phosphate is essential for the successful growing of roots in New Zealand. Under

the comparatively low rainfall conditions experienced in Canterbury there can be no doubt that superphosphate is the most efficient form of phosphate. Unfortunately, super sown in contact with the seed has an injurious effect on germination. The effect increases as the amount of super sown increases. It also varies with the amount of moisture in the soil at time of sowing. The following figures indicate the extent of the injury:—

1 cwt. of superphosphate (seed and manure in 14 in. rows): The average of twenty-five trials in which the germination on plots receiving 1 cwt. of super is compared with the germination on plots receiving no manure, ground rock phosphate, or super plus carbonate of lime (equal parts) shows that the super reduced the germination to 67 per cent. of that occurring on the other treatments mentioned. (Note: Experience indicates that rock phosphate or super plus carbonate of lime (equal parts) do not injure germination.)

2 cwt. of superphosphate (seed and manure in 14 in. rows): In twelve of these trials it was found that 2 cwt. of super caused more serious injury still, lowering the germination to about 47 per cent. of that from treatments which had no adverse effect. In one case a super 2 cwt. area germinated only 8 per cent. of that from the best treatment—super plus lime.

Superphosphate plus Carbonate of Lime.

The injury due to superphosphate can be entirely overcome by mixing the super with an equal weight of carbonate of lime (ground limestone) about one week before sowing. The average yields from ten trials in which super and super plus lime were used are as follows, all seed and manure being in 14 in. rows): Super 1 cwt., 11·2 tons per acre; super 2 cwt., 10·7 tons; super 1 cwt. plus carbonate of lime 1 cwt., 14·5 tons; super 2 cwt. plus carbonate of lime 2 cwt., 16·7 tons.

Recommendations to Growers.

(1) Mix superphosphate and carbonate of lime (equal parts) at least one week before sowing. The mixture should be left in a heap, as it tends to set if put in bags which are stacked. If left in a heap it can be easily broken up before use.

(2) Use 2 cwt. per acre of the mixture on light land, and 4 cwt. on heavier land of higher rainfall. It must be remembered that the lime will not replace the phosphate.

(3) Generally speaking, it will be advisable to sow 1 oz. to 3 oz. less seed than normally used, or the crop may be too thick.

Farmers are strongly recommended to try the super plus lime mixture. Provided weather conditions permit of germination at all, good results will be obtained. The mixing of super and carbonate of lime does not reduce the efficiency of the super to any appreciable extent.

—*A. W. Hudson, Crop Experimentalist, Plant Research Station.*

Lice in Sheep.—The Live-stock Division reports that during the past year a considerable reduction has taken place in the number of lice-affected sheep found in saleyards.

OFFICIAL HERD-TESTING OF PUREBRED COWS.

SUMMARY OF THE THIRD SEASON'S WORK, 1929–30.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

DURING the peak month of its third year of operation—covering the period 1st October, 1929, to 30th September, 1930—the Official Herd-testing system was carried out for some 1,338 cows in the hands of 130 of our C.O.R. breeders.

The general position regarding the number of cows tested and their average production, breed by breed, is indicated by Table 1. This table omits some forty-three cows other than registered purebreds, which were tested by special arrangement. The classification adopted is on the basis of all cows on test six months (180 days) or more, which so far has proved the most useful and representative. The O.H.T. is a ten months' test, 305 days being the maximum testing-period permitted by the rules under which this work is conducted. In connection with the season's testing it may be mentioned that the total number of cows entered on our lists was really 1,466. Although the total number appears in the table as 1,304, there were 115 registered purebred cows and four cows other than registered purebreds which did not complete 180 days on test.

Table 1.—Official Herd-testing in Two Part Seasons on Basis of all Cows on Test for 180 Days or more.

Breed.	Number of Breeders.	Number of Cows.	Average Yield for Season.		
			Days in Milk.	Milk.	Butterfat.
		Season 1928–29.			
				lb.	lb.
Jersey	99	817	276	5,705·1	306·30
Friesian	24	546	274	7,976·8	275·17
Ayrshire	8	106	282	7,182·8	280·89
Milking Shorthorn ..	7	108	266	6,496·6	250·39
Red Poll	4	59	261	5,901·1	239·77
Totals ..	142	1,636	275	6,618·3	288·17
		Season 1929–30			
Jersey	95	643	278	5,883·6	316·48
Friesian	17*	399	280	8,063·1	277·81
Ayrshire	8	97	281	7,204·9	285·75
Milking Shorthorn ..	7	131	273	6,561·5	254·07
Red Poll	3	34	282	5,975·4	242·04
Totals ..	130	1,304	279	6,717·5	294·21

* One Friesian breeder also testing Jerseys.

Figures taken out on the 100-days-or-more basis (the principal classification for ordinary Group and Association herd-testing) give an average O.H.T. production result of 287·56 lb. of butterfat in 273 days, as compared with 253·61 lb. in 247 days for all cows on ordinary

Table 2.—Average Production in Classes and Breeds for all O.H.T. Cows.

Class.	Season 1928–29.				Season 1929–30.			
	Number of Cows.	Average Days.	Average. Milk.	Average Butterfat.	Number of Cows.	Average Days.	Average Milk.	Average Butterfat.
Jersey.			lb.	lb.			lb.	lb
Two-year-old and under	283	274	4,849·7	261·68	246	282	5,105·9	276·92
Three-year-old	172	276	5,691·2	311·31	92	275	5,994·2	325·24
Four-year-old	115	276	6,151·0	333·48	89	270	6,209·7	337·00
Mature	247	278	6,487·3	341·27	216	280	6,587·9	349·34
Friesian.								
Two-year-old and under	183	279	6,751·8	234·88	112	282	6,500·9	228·08
Three-year-old	106	275	8,055·2	278·84	70	280	8,196·6	279·53
Four-year-old	75	273	8,906·2	303·35	70	278	8,737·4	296·86
Mature	182	269	8,779·8	301·94	147	279	8,868·7	306·36
Ayrshire.								
Two-year-old and under	19	287	6,187·7	253·79	18	286	6,508·2	263·69
Three-year-old	20	282	6,765·4	259·98	20	281	7,027·8	279·67
Four-year-old	21	276	6,987·9	275·93	15	265	6,367·1	256·32
Mature	46	283	7,864·3	303·43	44	284	7,856·1	307·56
Milking Shorthorn.								
Two-year-old and under	22	268	4,610·6	187·84	33	282	5,105·9	205·79
Three-year-old	19	272	6,143·1	227·97	19	263	6,309·8	247·98
Four-year-old	13	262	6,714·4	263·21	25	278	7,224·7	285·69
Mature	54	263	7,336·9	280·67	54	268	7,195·9	271·08
Red Poll.								
Two-year-old and under	18	263	4,842·7	194·20	10	289	5,483·0	231·35
Three-year-old	8	267	5,706·9	226·29	11	293	5,861·5	235·63
Four-year-old	12	260	6,203·7	259·30	2	272	4,610·7	202·23
Mature	21	257	6,709·8	272·81	11	267	6,785·1	265·41

herd-test during the 1929–30 season. The average production for all cows certificated under the C.O.R. system in 1929 was 469·95 lb. butterfat.

Table 2 provides a production classification according to age and breed.

Although last year Official Herd-testing showed a slight falling-off in number of cows tested as compared with 1928–29, present prospects indicate a considerable increase for the current year, 1930–31.

ESTABLISHMENT OF LUCERNE ROOT-NODULES.

FURTHER EXPERIMENTS WITH THE INOCULUM.

W. D. REID, Mycological Laboratory, Plant Research Station, Palmerston North.

IN an article which appeared in this *Journal* for February, 1929, on the result of mixing various fertilizers with inoculated lucerne-seed it was shown that superphosphate kills the nodule organism and that rock phosphates and basic slag do not. Since then field experiments have proved this first conclusion, and in the present account these trials and related experiments are discussed.

In the field trials sown in January last a closer approximation to normal farming procedure was obtained than in the previous laboratory experiments, the only variation from farmers' methods being that the sowing was done in 14-in. drills to facilitate later observations. Commercial lines of manures and seed were used, and the cultures for inoculating the seed were drawn from stocks prepared at the Mycological Laboratory and intended for distribution to farmers. In the inoculation of the seed the method followed our usual recommendations, which at that time suggested the use of one 6-oz. bottle of culture for 80 lb. of seed. Owing to the small quantity of seed required for the whole experiment, drying was rapid, taking not more than ten minutes from the time of application of the milk-culture. Apart from the application of inoculum the seed was not treated in any way prior to mixing with the manure. The seed and manure mixtures were drilled, in 14-in. drills, the seed at the rate of 14 lb. per acre, and the manure at 3 cwt. per acre, except sulphate of ammonia, which was sown at 1 cwt. per acre. Sowing was done half an hour after mixing the inoculated seed and manure, a delay which is more or less comparable with that which would occur on a farm.

After allowing three months for the development of the plants and nodules, portions of the plots were dug and the roots washed and examined. Table 1 indicates the lay-out of the plots (which were in duplicate) and the results obtained by the various treatments.

A general view of the areas showed outstanding growth differences, and the examination, as indicated, demonstrated extreme variations in the production of nodules. The examination showed that in those areas sown with super and sulphate of ammonia the nodule formation was negligible, or where, as in super D, a few were present they were limited to one or two on each of the positive plants. Further, in super D the plants with nodules were present in groups in which the

Table 1.

Plot.	Treatment.	Average Percentage of Plants with Nodules.	Average Number of Plants in 3 ft. of Drill.
1	Seed not inoculated, plus superphosphate C ..	0	78
2	Seed inoculated, plus sulphate of ammonia .	3	31
3	,, plus super C* . ..	0	86
4	,, plus super D* . ..	18	85
5	,, plus basic super .	78	95
6	,, plus super plus lime†	96	111
7	,, plus Nauru rock phosphate ..	98	121
8	,, plus Ephos phosphate	97	126
9	,, plus basic slag	99	119
10	Seed not inoculated, plus super D plus inoculated soil	26	68

* Super C and Super D are two different manufactures of commercial superphosphate.
† Super plus lime is a mixture of equal parts superphosphate and ground limestone.

nodules were confined to restricted centres of infection in the intertwined roots. Fig. 1 explains in part this grouping of the nodules. It appears that a limited spreading of the organism has taken place around some seed or seeds unaffected by the manure. The plant-growth of these super and sulphate of ammonia plots was poor both

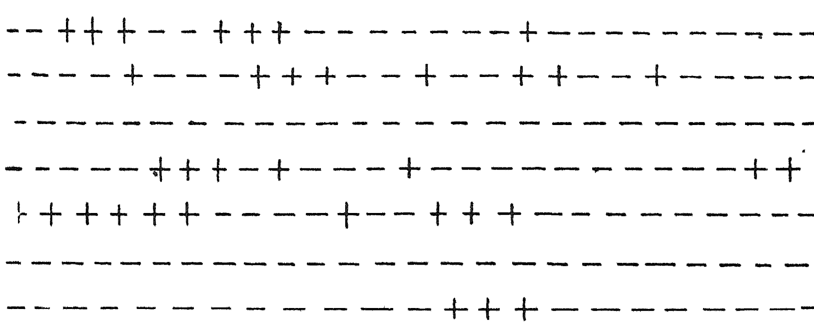

FIG. 1. RELATIVE POSITIONS OF THE PLANTS IN PORTION OF A SUPERPHOSPHATE "D" DRILL, SHOWING GROUPING OF THOSE WITH NODULES.

The rows in the diagram represent a continuous drill from left to right; hence the crosses (+ +) at the end of the third row and the beginning of the fourth are in the same group.

in vigour and colour, and a marked contrast to the healthy appearance of the other areas. Fig. 2 gives a good idea of this difference.

The basic-super treatments provided a satisfactory development of nodules and plants, although at the time of the examination the nodules were small and confined to the manure seed zone. The crop-growth was excellent, but no better than that of the super-plus-lime areas. This inoculation result does not agree with that obtained in the previous laboratory trials, in which a number of different lines of this manure killed most of the bacteria. Nevertheless, killing of the

bacteria to the extent of 20 per cent. did occur, and therefore, since more suitable fertilizers are available, the mixing of basic super and inoculated seed is not recommended.

Examination of the super-plus-lime, Nauru, Ephos, and basic-slag sowings showed plant inoculations of approximately 100 per cent., with an average nodule-production of ten nodules per plant. Further, in the super-plus-lime and basic-slag drills the nodules were not only present in the manure zone, but had also spread some inches below this level, suggesting that the conditions of sowing favoured a rapid

FIG. 2. VIEW AT JUNCTION OF TWO PLOTS, SHOWING CONTRAST IN GROWTH.

On left, superphosphate plot (inoculation nil); on right, basic super plot (inoculation 78 per cent.).

development and migration of the bacteria. In crop-growth the super-plus-lime plots, together with the basic-super plots, were the most vigorous of the experiment. The Nauru, Ephos, and slag plots showed good colour and growth, but not so luxuriant as that in the previous two treatments (Nos. 5 and 6).

The inoculated-soil plot (No. 10) was necessarily sown in a different manner to the others. In this case the inoculated soil, obtained from an established lucerne stand, was drilled in 14-in. drills, and in these drills was then sown the mixture of super and commercial seed. The result in nodule formation was unsatisfactory, though better than that in the super plus inoculated-seed plots.

For the first few weeks after sowing the above-noted differences of growth were not evident. The super, basic-super, and super-plus-lime

plots gave the best early growth, but in the case of super this advantage was not maintained, presumably because of the absence of nodules. The poor condition of the super and the sulphate of ammonia areas persisted for ten months, and thereafter a gradual recovery took place. A further examination showed the presence of nodules, but it appears that through intercultivation and harvesting operations the nodule organism was distributed from the adjoining plots, or, as in the case of super D, from the original nodule groups.

Effects of Drilling and Broadcasting Superphosphate prior to Sowing of Lucerne.

Since superphosphate is considered one of the most suitable fertilizers for the early establishment of farm crops, another experiment was laid down to determine if full nodule-development could be obtained when using this fertilizer and inoculated seed. The experiment comprised areas of (1) super drilled in at different times before cross-drilling the seed; (2) super broadcast at intervals before seeding; (3) seed and super sown through the same coulter, but from different boxes; and (4) the other phosphatic manures and seed sown through the same coulter, but from different boxes.

The subsequent examination showed a satisfactory result in the superphosphate areas, for fully 90 per cent. of the plants were inoculated. On the other hand, the plant growth in the super predrilled and broadcast plots was not equal to that obtained by the methods (3) and (4). The drilling of the super and inoculated seed from the same coulter certainly gave a good early growth, but some killing of the organism still occurred, for the nodules were present in groups and not evenly distributed along the drills. Basic super, and super plus lime both gave excellent plant and nodule growth; and the Nauru, Ephos, and slag treatments, though 100 per cent. inoculated, still showed the somewhat retarded plant-growth. This experiment has shown that super can be used when sowing inoculated seed, provided (*a*) the manure is applied prior to seeding, or (*b*) the seed and manure are drilled from different boxes of the drill. Basic super and super plus lime are more satisfactory if both factors of early plant-growth and nodule-production are considered

Longevity of the Organism on the Seed.

From time to time the question has arisen, How long will the inoculum remain viable after application to the seed? This problem has been subjected to a simple experiment in which the same line of inoculated seed has been sown at intervals from the time of treatment. The results were as follows:—

Time of Sowing Seed after Inoculation.	Percentage of Nodules.
2 days	100
4 days	100
1 week	100
2 weeks	95
3 weeks	95
4 weeks	4
6 weeks	Nil.

This experiment needs confirmation, but with our present knowledge it is evidently advisable to sow as soon as possible after treating.

Viability of Stock Cultures after Storage, and Rate of Application of Inoculum.

Another problem — of primary interest to this Laboratory — has arisen owing to the large demand for inoculum. During the season of 1929–30 cultures for over 18,000 lb. of seed have been supplied to farmers, and in order to economize laboratory work it has been found necessary to determine the viability of the organism in stock cultures and the amount of culture necessary to inoculate a given quantity of seed. For this field experiment the cultures were one, two, four, and six weeks' old at the time of application to the seed, and each one was applied at the rate of one 6-oz. bottle to 30, 60, 120, and 240 lb. of seed. The inoculated seed was sown with super plus lime from the same coulter, but from separate boxes of the drill. The results from all these variations of application were alike in that 100-per-cent. inoculations were obtained. The experiment has also shown that the present allowance of one 6-oz. bottle for 120 lb. of seed is more than sufficient, and that cultures prepared six weeks prior to application are as efficient as younger cultures.

Conclusions.

(1) The mixing of super or sulphate of ammonia with inoculated seed kills the nodule organism.

(2) The mixing of super plus lime, rock phosphates, or basic slag with inoculated seed gives excellent nodule - formation. Super plus lime gives the best plant-growth.

(3) Super can be used, provided (*a*) the fertilizer is broadcast or drilled before seeding, or (*b*) the manure and seed are drilled through the same coulter but from different boxes of the drill.

(4) Basic super or super plus lime when drilled as in (*b*) above gave the best plant and nodule growth.

(5) The drilling of super and seed over soil from an old lucerne stand has not proved satisfactory.

(6) The inoculum remains viable on the seed for three weeks in sufficient amounts to give good inoculation, but very poor inoculation was obtained after four weeks' storage.

(7) One 6-oz. bottle of Laboratory culture is sufficient to inoculate thoroughly 240 lb. of seed.

(8) Laboratory cultures may be kept for at least six weeks without loss of inoculating efficiency.

AREAS IN COMMERCIAL ORCHARDS.

THE total area of commercial orchards in the Dominion, as taken from the orchard registration cards for the year 1930–31 is 26,163 acres, comprising the following kinds of fruit: Apples, 17,855 acres; pears, 1,744; quinces, 198; peaches, 2,214; plums, 1,203; apricots, 885; nectarines, 359; cherries, 347; lemons, 956; oranges, 402 acres. Under the registration system "commercial orchard" is any orchard from which fruit is sold or intended to be sold, irrespective of the value of such sales.—*Horticulture Division.*

SOME COLOUR-PRODUCING ORGANISMS IN BUTTER-WASHING WATER.

G. F. V MORGAN, Dairy Bacteriologist, Wallaceville Laboratory.

DURING a recent bacteriological survey of the numbers and types of organisms found present in the waters used for washing butter in the various districts of the North and South Islands four types were isolated that are capable of rapid production of pigment. These organisms have been reported on by bacteriologists working on dairy-produce in all parts of the world, and cause sudden though not frequent epidemics of discoloration the cause of which is very often difficult to trace and equally difficult to eradicate, though the trouble often vanishes as suddenly as it makes its appearance.

So far no trouble of this nature has been reported to the Dairy Division in connection with milk and cream, in which the fault most often occurs, but varied discoloration takes place in many defrosted butter-samples, including red and violet colours. So far these colours have been found to be due to moulds of the *Fusarium* type and certain *Monilia*, but the possibility exists that the colour-producing organisms present in washing-waters may also play a part in causing this type of discoloration.

With the object of investigating this matter pure cultures of four colour-producing organisms were isolated from samples of dairy-factory water-supplies, and were introduced into milk and cream and, finally, butter. The organisms isolated were (1) *Chromobacterium violaceum*, (2) *Rhodococcus rosaceus*, (3) *Bacterium fluorescens*, and (4) a short gram-positive rod forming a bright-orange pigment.

CHROMOBACTERIUM VIOLACEUM.

This organism is a fairly widespread and common contaminant of water-supplies, and has also been isolated from bacteriological exposures of factory atmospheres. Cultures of the organism when introduced into milk produced bright violet spots over the surface, with a violet margin round the container, in two days. At atmospheric temperatures, when the milk is held for longer than this, rapid digestion commences, leaving a discoloured layer of cream and a brown-coloured serum beneath. The same action may be noticed in cream, the colour being confined to bright violet spots on the surface, and no discoloration in the body of the cream. The colour produced seems to be due to a skin or pellicle of the organisms themselves rather than to a diffusion of colour through the milk or cream.

When cream that had been inoculated with a culture of *Chromobacterium violaceum* was allowed to develop the violet spot, and was churned into butter and allowed to incubate for ten days at atmospheric temperature, the butter acquired a slightly grey appearance on the surface only, with occasional small but definitely violet spots. No discoloration was noticed in the interior when the butter was cut into sections for examination. The flavour produced was slightly rancid and similar to a coconut flavour.

FIG. 1. CHROMOBACTERIUM VIOLACEUM ORGANISMS AS SEEN UNDER THE MICROSCOPE.

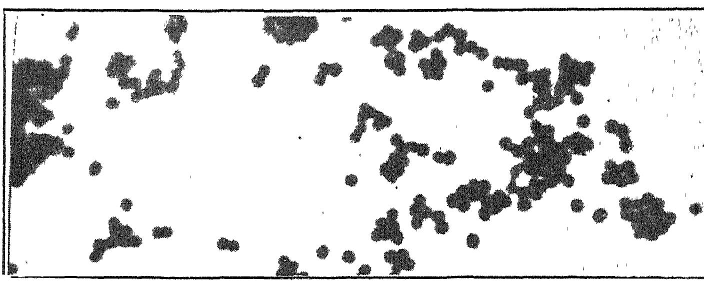

FIG 2 RHODOCOCCUS ROSACEUS.

FIG 3. BACTERIUM FLUORESCENS.

FIG. 4. THE ORGANISM WHICH PRODUCED A BRIGHT ORANGE COLOUR.

The cultural characteristics of *Chromobacterium violaceum* as observed were as follows: Milk and cream—violet patches on the surface only, followed by liquefaction; gelatine—liquefied; potato—weak growth; agar slant—deep violet glistening, forming a raised wrinkled violet skin in old cultures; gram negative rod; habitat—water.

RHODOCOCCUS ROSACEUS.

A culture of this organism was introduced into milk and held at 20° C. for two days. On examination a pink sediment was seen at the bottom of the flask, resembling the red deposit present in milk containing small quantities of blood—acidity produced—no coagulation, but slow digestion. In butter the colour is too light to be distinguishable. Confusion has sometimes arisen in bottled milks between milk containing this organism and milk containing small quantities of blood.

Cultural characteristics: Milk—acid digestion with red sediment; gelatine—slow liquefaction; agar—light pink, flesh-coloured growth luxuriant; gram positive coccus, growing best at low temperatures.

BACTERIUM FLUORESCENS.

Only recently have water cultures from certain butter-factories been found to contain this type of organism. It is, however, common and widely distributed in farm waters of a bad type, more particularly stagnant waters containing an excess of decaying vegetable matter. This organism produces a marked green pigment diffused through a clear medium on which it may be growing; the green colour, however, does not appear in dairy-produce, owing to the acidity developed by other organisms.

This type of organism is particularly dangerous as a contamination in butter-washing water, as it is among the few that have marked fat-splitting abilities and are therefore capable of rapidly producing rancidity, the rancidity and bad-flavour production starting from the outside of the butter and working inwards.

The pigment production that appears quickly in ordinary agar-shake cultures is of little importance in itself, except for the fact that it readily draws attention to the presence of this highly undesirable type of organism.

Cultural characteristics: Agar slant—viscous creamy growth; milk—alkalinity, coagulation and digestion (slow and viscous); gelatine—rapid liquefaction; gram negative rod.

CHROMOGENIC BACTERIUM ISOLATED AT WALLACEVILLE (CLASSIFICATION UNCERTAIN).

From cultures of certain factory water-supplies bright orange colonies have from time to time been isolated. These have been proved to consist of short, thick, gram-positive rods occurring in pairs producing a bright orange pigment in their colonies, but no diffusion of colour into the body of the medium in which they may be growing.

Cultures of this organism were introduced into milk and cream which was held at atmospheric temperature for three to four days. By

this time a thick orange surface-growth had appeared on the milk and cream, which gradually diffused into the body of the milk; a thick orange sediment was also apparent.

Butter was subsequently made from the inoculated cream, but showed no marked development of colour. The outside layers of the sample made from inoculated cream seemed in ten days slightly deeper in colour than that of the control. Cultures from this sample at this age showed that the organisms were still virile and present in considerable numbers.

Cultural characteristics: Milk—bright orange surface-growth and sediment; agar slant—bright orange, glistening, moist; gelatine—orange growth, slow liquefaction; potato—bright orange, dry; no acidity production; lactose not fermented; gram positive.

CLUB-ROOT IN TURNIPS

TEN YEARS' INVESTIGATION IN OTAGO AND SOUTHLAND.

R. B TENNENT, Fields Superintendent, Department of Agriculture, Dunedin.

WITH the return of the season when turnip and swede growing is receiving consideration it will be opportune to review the work conducted by the writer in regard to the control of club-root (*Plasmodiophora brassicæ*) in this crop during the past ten years. In this article the general term " turnip " is used to include both ordinary and swede varieties.

In the early stages of investigation the writer was impressed by the reiterated assertions in agricultural text-books lauding the efficacy of lime in controlling club-root, and trials were laid down on the Gore Experimental Area for the purpose of determining if lime actually was effective in controlling club-root. At the outset some doubt was felt as to its efficacy, seeing that over 60,000 tons of lime was being used annually in Otago and Southland and yet club-root had been increasing year by year.

LIMING EXPERIMENT FOR CONTROL OF CLUB-ROOT.

In November, 1920, a piece of land on the Gore Experimental Area, known to be heavily infected with club-root, was selected for the purpose of testing the value of lime for control. This plot was divided into five equal blocks running north and south, and treated with the following applications of burnt lime per acre: Plot 1, 2 tons; Plot 2, 16 tons; Plot 3, control (no lime); Plot 4, 8 tons; Plot 5, 4 tons.

In 1921, a year after the application of lime, a crop of cabbages grown on a portion of this block reached maturity during the season, and the plants were then pulled and examined (by naked eye) for the presence or otherwise of club-root, with results as shown in Table 1. The result of this portion of the trial clearly indicated that the application of lime did not lessen the percentage of infection.

In 1922, two years after the application of lime, a crop of Hardy Green Globe and Webb's Renown turnips was sown down on the limed block, with a view to ascertaining whether after a period of years had

Table 1.

Plot.	Lime per Acre.	Total Number of Plants.	Percentage of Infection.
	Tons.		
1	2	91	26
2	16	97	13
3	Control (unlimed)	114	13
4	8	114	18
5	4	106	15

elapsed since the application of lime its effectiveness might be enhanced. These crops grew to maturity and the following results were obtained :—

Table 2.

Plot.	Quantity of Lime per Acre applied in 1920.	Yield per Acre, 1922–23.		Percentage of Club-root Infection.
		Hardy Green Globe.		
	Tons.	Tons	Cwt.	
1	2	22	6	57·0
2	16	28	0	3·0
3	..	25	9	48·3
4	8	35	6	24·0
5	4	31	0	20·8
		Webb's Renown.		
1	2	20	2	9·5
2	16	25	0	9·6
3	..	16	0	21·6
4	8	26	16	12·0
5	4	24	13	16·8

The results of this trial offered interesting material for thought, and apparently point to lime, after being several years in the soil, having some inhibiting effect on the prevalence of the club - root organism. Where large quantities of lime had been applied, as in the case of the plot which received 16 tons per acre, there was certainly less disease apparent than in the plot which received no lime. One would like very much to use these results as an argument that lime when applied in fairly large quantities would lessen the disease, but the figures must not be accepted on their face value as giving a true indication of the intensity of attack. The plots were small and the roots grown thereon few in number. One or two bulbs attacked by the disease consequently make the percentage of infection read very high. In other words, this experiment will not bear critical examination on account of the fact that an insufficient number of replications of each treatment were carried out. Furthermore, there is every likelihood that the ground upon which the experiment was conducted was not uniformly infected to the same intensity, and this would certainly make for wrong interpretation of results. All that can be said in regard to the experiment is that a strong indication was given supporting the oft-repeated assertion that lime counteracts club - root ; further, as a result of these

experiments it would appear that the effect of lime in this connection is not apparent until some years after the application has been made.

In 1924 an improved type of trial was conducted on the Gore area. More replications were made, and the trial was of a dual nature in that a comparison was attempted between a Danish swede named Bangholm—supposed to be fairly resistant to club-root—and a well-known commercial variety of swede. The results of this experiment, carried out four years after the original liming, are shown in Table 3. The table combines four plots in each of the two varieties, and averages the percentage of infection under each heading.

Table 3.

Variety.	4 Tons Burnt Lime per Acre.		Percentage of Infection.	8 Tons Burnt Lime per Acre.		Percentage of Infection.	Control (no Lime).		Percentage of Infection.	16 Tons Burnt Lime per Acre.		Percentage of Infection.	2 Tons Burnt Lime per Acre.		Percentage of Infection.	Average Percentage of Infection over 5 Plots.
	Club-rooted	Sound.		Club-rooted	Sound.		Club-rooted	Sound.		Club-rooted.	Sound.		Club-rooted	Sound.		
Bangholm ..	26	69	27·3	44	84	34·3	41	91	31·0	35	98	26·3	46	57	44·6	32·7
Commercial ..	82	19	81·9	77	31	71·3	145	11	93·0	96	35	73·3	96	4	96·0	83·1

NOTE.—The figures under " Club-rooted " and " Sound " represent numbers of roots.

Again in this case there are indications that lime, even four years after application, has some tendency to control club-root, although it has to be admitted that the results are not very encouraging. It appears anomalous that the percentage of infection where 2 tons of lime was applied per acre should be higher than where no lime was used, but probably the difference is non-significant.

It will be observed that in this trial Bangholm swede showed a distinct superiority in club-root resistance to the commercial variety grown, and this test was really the forerunner of numerous others conducted in an endeavour to determine whether certain varieties or strains of turnips were actually club-root resistant.

The whole question of the effect of lime upon club-root is at present being again reviewed in comprehensive trials laid down this year at Gore Experimental Area, and at the Plant Research Station, Palmerston North.

TRIALS OF SO-CALLED CLUB-ROOT-RESISTANT STRAINS OF TURNIPS AND SWEDES.

It has always been recognized that individual roots within a crop of turnips show a marked resistance to club-root disease, and one of the most hopeful types of investigation has been to ascertain whether there does exist any particular variety or strain of turnip or swede which will grow well in club-root-infested ground. Numerous trials have been carried out at the Gore Experimental Area with the object of ascertaining if the claims made by certain breeders of turnip-seed in regard to club-root resistance were justified, and in the majority

of cases negative results were obtained. It is not intended in this article to traverse all the experiments laid down in this connection, but brief mention will be made of those which showed promise.

In 1923 the writer had the opportunity of testing a Danish swede named Bangholm Purple-top, for which was claimed ability to withstand heavy club-root infection. This swede was sown on severely club-rooted land on the Gore Area, and of 120 roots pulled and inspected nineteen were found to be infected. There is no question that this Bangholm swede was moderately resistant to club-root, but its chief disadvantage lay in the fact that the bulb itself was poor in shape with very fangy roots.

A further trial of this swede was conducted in 1924 on the block referred to in the liming section of this article, this ground having been limed four years previously. As already mentioned, the Bangholm swede in this case showed a marked superiority over the commercial variety, less than 33 per cent. of the former being infected with club-root as against 83 per cent. in the case of the latter. This was a decidedly hopeful experiment, and clearly demonstrated that there did exist certain types of turnips more resistant to club-root than others.

During the same season, 1924, a number of trials were conducted on various farmers' properties, both with ordinary turnips and swedes, and were fully reported on in this *Journal* for April, 1925.* Of all the trials conducted during that season the most promising results in swede varieties were obtained from the Bangholm, and in turnips from Irvine's Green-top Yellow. In 1928 the Department of Agriculture obtained from Denmark a sample of swede-seed named Bangholm Improved Purple-top Herning Strain. Reports had been noted in regard to the club-root resistant qualities of this strain of Bangholm swede, and it was immediately put under trial. This strain of specially selected seed is referred to hereafter as Herning swede.

Trials with Herning Swede.

There can be no question that of all the trials conducted in an effort to obtain a club-root resistant swede those with Herning have proved the most successful, and the growing of this variety on club-root-infected land merits close consideration.

In 1928-29 a trial of Herning swede was conducted at the Gore Experimental Area, two other well-known and popular varieties of swedes being used as a control. The seed of all varieties was ridged in plots 2 chains in length, each plot consisting of four drills, and being replicated twelve times. The seed was sown at a rate of 1 lb. per acre in land heavily infected with club-root.

Although no germination counts were taken a good even germination occurred with each variety, there being no visible differences to record. From the time of germination until the beginning of January growth throughout proved fairly even and regular. At the time of thinning, however, during the middle of January, it was noticeable that, with the exception of the Herning strain, each variety of swede was badly infected with club-root. At the beginning of February each of the

* This article also discussed the great economic importance of the turnip crop to Otago and Southland, and consequently the necessity for club-root control work

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Trials with Herning Swede.

There can be no question that of all the trials conducted in an effort to obtain a club-root resistant swede those with Herning have proved the most successful, and the growing of this variety on club-root-infected land merits close consideration.

In 1928-29 a trial of Herning swede was conducted at the Gore Experimental Area, two other well-known and popular varieties of swedes being used as a control. The seed of all varieties was ridged in plots 2 chains in length, each plot consisting of four drills, and being replicated twelve times. The seed was sown at a rate of 1 lb. per acre in land heavily infected with club-root.

Although no germination counts were taken a good even germination occurred with each variety, there being no visible differences to record. From the time of germination until the beginning of January growth throughout proved fairly even and regular. At the time of thinning, however, during the middle of January, it was noticeable that, with the exception of the Herning strain, each variety of swede was badly infected with club-root. At the beginning of February each of the

* This article also discussed the great economic importance of the turnip crop to Otago and Southland, and consequently the necessity for club-root control work.

popular varieties had almost died out with club-root, but the Herning continued to grow vigorously. Only a few isolated plants of the popular varieties remained, forming a striking contrast to the dense rows of well-grown Herning bulbs.

A final examination of the block was made on 22nd May, 1929. By this time Herning was the only variety left growing, and a close examination was carried out to ascertain the percentage of club-root and dry-rot infection present. Of 741 roots examined 145 proved to be infected with club-root and 313 with dry-rot. The yield from the crop of Herning was estimated at 26 tons 13 cwt. 3 qr. per acre, whereas no yield was obtained from the other varieties.

In view of the fact that this trial was conducted on land heavily infected with club-root, there is ample evidence that the Herning strain of Bangholm Improved Purple-top swede is highly resistant to the disease. It is not immune, however, from club-root or dry-rot.

In 1929 a further trial was laid down at Gore to obtain confirmatory evidence in regard to the resistance of Herning swede. The nature of the trial was similar to that sown down in 1928, three commercial varieties of repute being used as controls. In this trial each plot consisted of two ridged drills of the four varieties, ten replications of the commercial swedes being made as against fifteen replications of Herning. An even germination was obtained on all plots, but at thinning-time the commercial varieties were farther ahead in growth than the Herning. At the date of weighing the various plots it was quite obvious that the Herning swede was much freer from club-root than any of the other varieties (see Fig. 1). In places the commercial varieties were completely destroyed. Although a number of the Herning swedes were affected with club-root the disease did not appear to seriously incapacitate the plants, which, relatively speaking, afforded an abundance of edible material. This trial was of an extremely severe nature, the block having been sown down to swedes in each of the three years preceding the trial, and it is amazing that any swedes at all grew on that particular area. The results of this trial were as follows:—

Table 4.

Varieties.	Yield in Tons per Acre.	Average Number of Roots examined per Plot.	Percentage affected with Club-root.
Herning	15·8	66·27	54·4
Commercial W	1·7	24·0	94·6
Commercial S	2·7	25·0	86·8
Commercial E	4·7	35·6	90·4

It should be noted in regard to this trial that although the Herning swede had 54·4 per cent. of roots infected with club-root, as against 86·8 per cent. in the case of "Commercial S," the number of roots examined in the former case was appreciably more, because many roots of the other varieties had been killed off in the early stages by the disease. The percentage of plants affected after germination would thus be much higher in the case of "Commercial S," "W," and "E" than the figures in the table indicate.

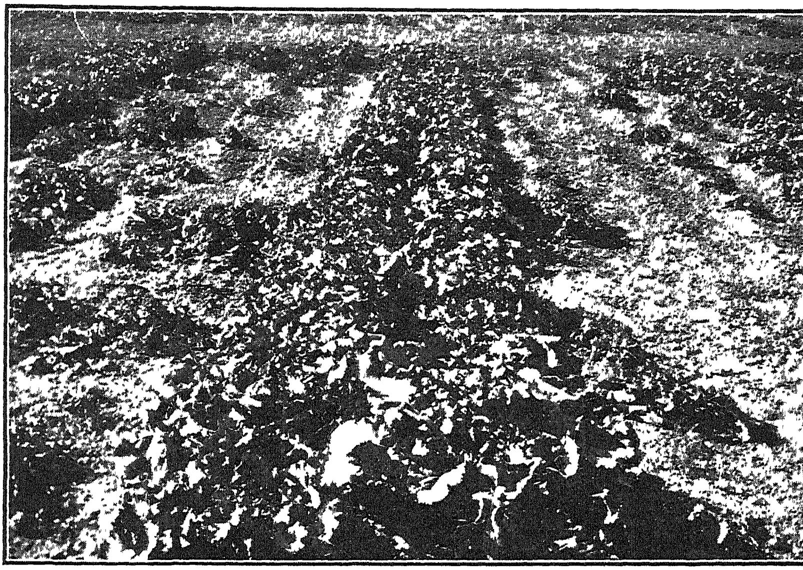

FIG. 1. HERNING SWEDE AT GORE EXPERIMENTAL AREA SHOWING RESISTANCE TO CLUB-ROOT.

The two centre drills are Herning growing in badly club-rooted ground. On either side are two drills each of well-known commercial varieties which have succumbed to club-root attack.

FIG. 2. HERNING SWEDE AT WINTON EXPERIMENTAL FARM.

The two central drills are Herning, showing resistance to club-root in infected ground. Here, again, two drills of commercial swedes on each side have failed to withstand the attack of the disease.

[*Photos by E. Bruce Levy.*

During the same season a confirmatory trial was carried out at the Winton Experimental Farm, and results comparatively similar to the foregoing were obtained (Fig. 2).

As a result of these trials no doubt was left in the writer's mind that at last a strain of swede had been found which was definitely superior to the ordinary commercial varieties in club-root resistance. It has to be borne in mind, however, that this variety is not immune to club-root. It would appear that there is ample scope for improving the existing Herning strain by further selection, and this is work which undoubtedly should receive earnest attention.

YIELD TEST.

It had been suggested that resistant strains of swedes were poor yielders and unpalatable to stock. During 1928 these points were investigated, and the Herning swede was sown in competition with a number of commercial varieties on the property of Mr. K. Rodger, Tapanui. In this trial the Great Crop variety of swede was used as a control. The experiment was laid down on 12th December, 1928, and the resultant crop harvested on 11th June, 1929. All varieties of swedes were sown at the rate of 1 lb. per acre, with a mixture per acre of superphosphate 2 cwt., blood-and-bone 1 cwt., and carbonate of lime 2 cwt. The yields given in the table below are the average of six weighings in a single row.

Table 5.

Variety.	Yield per Acre	Difference from Control	Variety.	Yield per Acre.	Difference from Control.
	Tons.	Tons		Tons.	Tons.
Great Crop ..	26·9	..	Great Crop ..	32·4	..
Superlative ..	30·0	+4·0	Abundance ..	31·8	− 0·6
Masterpiece ..	28·4	+0·9	Commercial E ..	11·7	−17·1
Great Crop ..	27·5	..	Great Crop ..	29·1	..
Crimson King ..	26·6	−0·8	Up-to-date ..	30·3	+ 1·2
Imperial ..	24·8	−3·1	Buffalo ..	30·4	+ 1·5
Great Crop ..	28·0	..	Great Crop ..	28·9	..
Elephant ..	26·3	−1·6	Monarch ..	29·0	+ 0·09
Champion .	28·8	+1·9	M. J.	29·2	+ 2·08
Great Crop ..	26·8	..	Great Crop ..	27·1	..
Magnum Bonum	30·5	+3·7	Hunsballe ..	25·4	− 1·7
Balmoral ..	28·7	−3·7	Herning ..	33·3	+ 4·4
			Great Crop ..	29·0	..
			A. Q.	34·5	+ 5·5

From this table it will be observed that Herning gave the second highest yield, thus proving that this variety is quite capable of more than holding its own as a cropper in competition with commercial varieties.

PALATABILITY TEST.

In order to test the palatability of Herning the experimental block on Mr. Rodger's farm was divided into three breaks, each of which included six drills of the several varieties, and forty wethers were used to feed these off. The observations made are presented in Table 6.

Table 6.

Order of Preference.	Break 1: Fed off 18th July.	Break 2: Fed off 15th August.	Break 3: Fed off 9th September.
1st	Hunsballe ..	Herning	Up-to-Date
2nd	Magnum Bonum ..	Up-to-Date ..	Herning.
3rd	Monarch	Magnum Bonum ..	Magnum Bonum.
4th	Herning	Hunsballe ..	Monarch.

This trial clearly indicated that Herning swede was quite palatable to stock, both in early and late feeding. Confirmation as regards the palatability of Herning was also afforded by a trial on the farm of Mr. A. W. Taylor, Wallacetown, in which five varieties of swedes—Grandmaster, Superlative, Masterpiece, Elephant, and Herning—were sown. Ewes turned on to this block showed a decided preference for the Herning swedes, these being completely topped before any of the others were touched.

Summary of Otago and Southland Trials.

(1) Burnt lime, using various quantities up to 16 tons per acre, while not a completely effective means of controlling club-root, has appeared to generally lessen the incidence of the disease after the lapse of two years from the time of application. Further work in this connection is desirable.

(2) Bangholm Purple-top swede and Irvine's Green-top Yellow turnip have given distinct promise of being relatively resistant to club-root. Further trials with Irvine's turnip are warranted.

(3) Bangholm Improved Purple-top Herning strain swede has proved superior to the original Bangholm not only in regard to shape, rooting-capacity, palatability, and yield, but also in regard to club-root resistance.

(4) Herning swede is only resistant to a certain degree. It is not immune, but on badly infected club-rooted land a crop can be obtained by using it when other commercial varieties may fail.

(5) Further trials with Herning swede are desirable, with a view to improving its resistant character by selection.

(6) The growing of certified improved Herning swede seed in New Zealand is warranted and should prove of great economic importance.

Quality of New Zealand Butter.—The annual report of the Dairy Division for 1929–30 states that despite the large increase in production, the quality of creamery butter has probably never previously reached so high a uniform standard of excellence, the average grade for the year being 92·96, as compared with 92·84 for the previous year. Butters scoring Finest exceeded the preceding year's figures by 4·5 per cent., the totals being 74·41 and 69·91 per cent. respectively. The percentage of First grade was 25·09, as compared with 27·82 per cent., and under First 1·5 and 2·27 per cent. respectively. "Soda" flavours have been rarely commented upon, and the highly uniform character of the body and texture, together with the even distribution of the moisture content and greater attention paid to the better packing and finish of our butters, is a testimonial to the excellent team work of the factory staffs.

PASTURE TOP-DRESSING IN CANTERBURY.

EXPERIMENTAL WORK BY THE FIELDS DIVISION.

(Continued.)

A. W. HUDSON, Crop Experimentalist, Plant Research Station, Palmerston North, and A. Y. MONTGOMERY, late Assistant Crop Experimentalist

PART II. OBSERVATIONAL EXPERIMENTS WITH LIME, PHOSPHATE, POTASH, AND NITROGEN, 1928-29 AND 1929-30.

THESE experiments constituted a plot survey of Canterbury. Approximately two hundred plots were laid down, distributed as shown in the sectional maps. Fig. 2 shows the type of experiment used, and it will be noticed that each treatment is in duplicate. One series of plots was fenced and grazed under the system of intermittent or rotational grazing, while the other series was under the same management as the remainder of the paddock in which the experiment was situated. The system adopted had been practised on a small scale on Banks Peninsula in 1927, although the treatments under trial were different, as will be presented in Part III.

The objects of the experiments were as follows :—

(1) To determine the response to lime, phosphate, potash, and nitrogen in the various districts and soil-types of Canterbury which were under arable farming.

(2) To determine the effect of regular applications of phosphate, potash, and nitrogen on limed and unlimed ground, on the composition of the different swards under trial, and on the persistency of the species constituting the swards.

(3) To determine the effect of the treatments used under (*a*) a system of intermittent grazing and (*b*) the system as normally practised on the particular farm—which might be anything from a near approach to intensive rotational grazing to quite haphazard grazing and control of pasture.

(4) To determine the duration of the visible effect from a dressing of 1 ton of carbonate of lime per acre.

It is obvious that manure responses could not be measured on an economic basis, but it was practically certain that in a good many cases the results would be so definitely in favour of or against a particular treatment that reasonably safe conclusions could be drawn regarding its economic value. On the other hand, it was realized that in a number of cases there would be responses to the treatments applied, but on account of the smallness of the responses, coupled with naturally low fertility, the question as to whether the treatments paid or not would be extremely doubtful.

PLAN OF STANDARD EXPERIMENT.

Fig. 1 shows the standard plan adopted for this series of experiments. It will be seen that the total area occupied by each experiment is 2 chains by 1⅓ chains, and that individual plots are ⅓ chain or 22 ft. square.

Where *observation* of effect of treatments is all that is required, small plots have a very decided advantage over large ones for the following reasons: (1) A uniform sward can be selected on which to lay down the plots; (2) on account of their close proximity to one another treatments can be compared readily; (3) where treatments affect

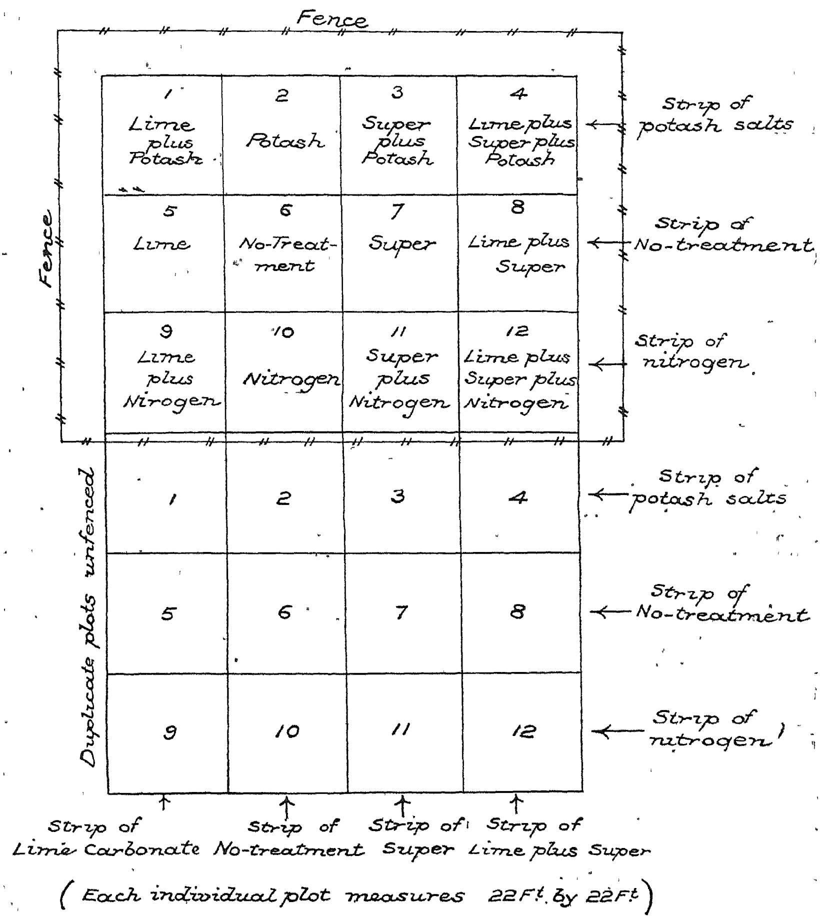

FIG. 2. PLAN OF STANDARD EXPERIMENT ADOPTED FOR THE CANTERBURY SURVEY.

palatability, as evidenced by different intensities of grazing by stock, such effect is just as clearly marked on plots of a few yards square as when plots are several chains or acres in extent; (4) where a manure-response survey is being conducted a very large number of experiments can be laid down with a comparatively small expenditure of money and time; (5) a large number of small experiments serve the interest of a greater number of farmers than a few large-scale ones.

There is no particular reason for making plots $\frac{1}{3}$ chain square; generally speaking, it is probably more convenient if they are an even fraction of an acre, such as $\frac{1}{100}$ or $\frac{1}{200}$. In a new series of experiments which aim at a survey of New Zealand in the same way as has been done in Canterbury the size of the individual plot is 25 links by 20 links = $\frac{1}{200}$ acre.

Manuring Programme.

In deciding on the quantities of manure per acre the question of whether the rate of application was an economical one for each particular soil-type was not considered. The chief point to be decided was, Did the particular treatment have any effect? Consequently reasonably heavy dressings were adopted.

The quantities applied in 1928 were as follows:—

(1) Carbonate of lime (ground limestone) ..	1 ton per acre.
(2) Superphosphate (44/46% tricalcic phosphate)	3 cwt. per acre.
(3) 30% potash salts	2 cwt. per acre.
(4) Sulphate of ammonia	3 cwt. per acre (three applications of 1 cwt. each).

The initial dressings were made during the winter and early spring of 1928. In the case of sulphate of ammonia a second dressing of 1 cwt. per acre was applied about November-December, and a third dressing about March–April of 1929. (Note.—Nitrate of soda was used for the first dressing of nitrogen in a number of the experiments.)

In 1929 no further application of lime was made, but fertilizers were used as follows:—

Superphosphate	2 cwt per acre.
30% potash salts	2 cwt per acre.
Sulphate of ammonia	2 cwt. per acre (two applications of 1 cwt each).

As far as possible, applications of super and potash were made in the autumn (March–April), although a good many experiments could not be dressed until May and June. The experience in 1928 indicated that the November–December application of sulphate of ammonia did temporary harm rather than good when conditions were dry. Usually, too, there was a superabundance of grass at this time and a further stimulation of growth could serve no particular object, consequently the application of nitrogen was confined to the July–August dressing in 1929 and the March–April one in 1930.

In 1930 a number of trials have had to be abandoned on account of the pastures having run out, necessitating ploughing up. However, a good proportion are being continued under the same top-dressing programme as in 1929. In light of the work conducted on rye-grasses by Messrs. Levy and Davies, as referred to in Part I, it seems reasonably certain that the rapid deterioration of pastures in Canterbury is due to the type of rye-grass used. The replacing of the present Canterbury strains by certified perennial rye-grass will undoubtedly lead to the maintenance of a much better sward in the second and subsequent seasons in the life of the pasture. Under such conditions manuring will be more profitable, for instead of manuring to induce volunteer growth, manuring will be applied to persistent constituents which were actually sown.

DISTRIBUTION OF EXPERIMENTS.

All Farmers' Union branches throughout Canterbury were invited to co-operate in the experimental scheme, and the majority assisted materially by submitting names of farmers willing to provide paddocks on which experiments could be laid down. Approximately five experiments were arranged for in each local district. The location of the experiments was indicated by the general map printed with Part I in last month's *Journal,* and larger-scale district maps accompany the detailed results appended to the present Part II.

In the detailed notes the experiments are arranged according to Farmers' Union districts, and following the notes on each district a brief summary is made in which in some cases an opinion is expressed regarding the payable nature of the manure responses. The notes are a very brief résumé of all observations made over a period of about two years. It is impossible to discuss each individual experiment in detail, and readers are reminded that while the effect of a manure might be very striking at one time of the year at another time no visible effect would be apparent.

DISCUSSION OF RESULTS.

(1) RESPONSES TO LIME AND MANURES.

The following table summarizes the responses from the major treatments and combinations of treatments used. The percentages of the trials falling in each of the classes from "No visible response" to "Excellent response" are shown. A full explanation of the system of classifying responses is given in the notes preceding Appendix A.

Table 1. Percentages of Responses to Major Treatments in the Experiments which fall in the various Response Classes.

Treatment.	Degree of Response to Treatment.							Total Number of Experiments in which Treatment was used.
	No Visible Response. (0)	Doubtful Response. (?)	Slight Response. (1)	Fair Response (2)	Good Response. (3)	Very good Response. (4)	Excellent Response. (5)	
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	
Lime ..	5	5	29·5	28·5	26	6·5	..	201
Super ..	5	3·5	26·5	33	24	7·5	1	201
Lime plus super	2	4	6·5	12	23·5	23	29·5	201
Potash ..	83·0	7	4	3·5	2	..	..	196
Nitrogen ..	0·5	1	4·5	30	51·5	12·5	..	193

COMMENTS ON RESPONSES TO TREATMENTS.

Lime.—Hitherto lime has not been viewed as an important limiting factor to the production of pasture in Canterbury. These experiments show only 5 per cent. of cases in which there is "no visible response." The 5 per cent. of "doubtful responses" include experiments which have been down for one year only at the time of writing. A "slight response" is recorded in 29·5 per cent. of cases, while "fair to very good" responses are represented by 61 per cent. of the trials. From the point of view alone of

increased benefit to stock in supplying lime through medium of the pasture the writers are of the opinion that its use is justified in practically all Canterbury soils.

In many places the increased growth of herbage, especially where superphosphate was used in addition, leaves no doubt in our minds regarding the economic value of liming from the production aspects. It is of interest to note that some of the highest responses to lime have occurred on the light to medium soils overlying shingle, such as those in the vicinity of Sherwood and Lauriston in Ashburton County.

Duration of effect of lime: Experience from plots which have been down for several years on high-lime-response country indicates that the visible effect of a dressing of 1 ton of carbonate of lime per acre should extend over a period of five or six years at least (see Fig. 4, App. A). Smaller quantities should give results which are more or less proportionate to the amount applied. The present series of experiments has not been down sufficiently long to enable general conclusions regarding the duration of effect from lime to be determined on them. On some soils the effect of lime was visible four to five months after application, and, generally speaking, the effect was much more marked in the second year than the first.

Superphosphate.—"No visible response" to super is recorded in 5 per cent. of the trials, while 3·5 per cent. are in the "Doubtful response" class, 26·5 per cent. are recorded as "Slight response," 33 per cent. under "Fair response," and 24 per cent. under "Good." The "Very good" and "Excellent" classes are represented by 7·5 per cent. and 1 per cent. of cases respectively.

In the cases of both lime and super the classification of responses is made more or less relative to the responses from the combination of lime plus super. Consequently the responses to the individual treatments appear relatively smaller—as was actually the case—than the responses from the combination lime plus super.

In many of the experiments on the very light lands "fair" and in some cases "good" responses can hardly be paying. It is noteworthy that on this class of land the use of super *drilled into the ground at the time of sowing* with any crop, including grass, is undoubtedly paying. The use of super as a top-dressing on established grassland is, however, not productive of sufficiently good results to encourage one into thinking that it can be profitable, on the typical lower-rainfall areas at least. Some method whereby super can be actually placed in the soil to a depth of 2 in. to 3 in. may give much better results, and is certainly worth trying.

Lime plus Superphosphate.—The effect of the combination of lime and super has been an outstanding feature of the trials. Almost without exception the combination has proved superior to either material alone. In about 10 per cent. of the trials no visible response from one or other of the individual treatments was discernible, but when combined a distinct response has been noted.

In only 2 per cent. of cases is "no visible response" recorded. In 76 per cent. of the trials the lime plus super plots are fairly evenly distributed over the "Good," "Very good," and "Excellent"

response classes, slightly more being recorded under "Excellent" than in either of the other two classes mentioned.

The importance of the lime plus super combination in connection with the establishment and maintenance of pastures of short or long duration cannot be stressed too strongly. Experience indicates that rye-grass responds almost as well as clovers, if not quite as well, to the addition of lime to soils deficient in it. The duration of effect of lime was discussed above, and the argument that liming is expensive cannot be admitted when it is remembered that the effect of a dressing of about a ton will continue for five or six years. It is obvious that the best results cannot be got from super if lime is deficient.

Potash.—The results obtained indicate that in the main potash is not a serious limiting factor to pasture production in Canterbury; 83 per cent. of the experiments showed no visible response to potash, in 7 per cent. the response was "doubtful," in 4 per cent. "slight," and in 2 per cent. "good." Where responses did occur they were most marked as a rule where the potash plot crossed limed ground. The claim that potash, though ineffective in improving yield, has a marked effect on the quality and feeding-value of grass herbage has not been substantiated so far as the writers are aware.

Nitrogen.—Responses to nitrogen were particularly consistent, over 80 per cent. of the experiments falling in the "Fair" to "Good" classes so far as this factor was concerned. Generally speaking, the better the rye-grass and cocksfoot content of the sward the better the response to nitrogen. The best results, too, were obtained where the nitrogen plot crossed lime plus super, although very often the super plus nitrogen plots were good.

In practically all experiments the best plot of the series was that receiving lime plus super plus nitrogen. It must be remembered, however, that from the commencement of the trials until May, 1930—just under two years—most of the experiments had received 5 cwt. of nitrogenous fertilizer per acre, at a cost of about £3 5s. per acre. In addition to the period of two to three months after application, when the nitrogen exercised a direct influence, there has been a general improvement in the grass sward. The growth of clover has been reduced in a good many cases, but as a rule the reduction in clovers did not appear to be serious on the lime plus super plus nitrogen plots. We do not venture an opinion as to whether or not the use of nitrogen at its present price is paying. This must depend on a number of factors; but one thing is certain—namely, that nitrogen will not pay on pastures which are lacking in the major species of grasses—rye-grass and/or cocksfoot.

To those farmers who desire to try nitrogen, our advice is: (1) Use it on pasture which has been limed and phosphated; (2) use it only for the production of early spring grass by applying it in late July or early August, and possibly for production of early winter feed by applying in March or April; (3) use it on good pastures only; (4) feed off the resultant growth while it is still young and palatable. These remarks apply only to pastures used for grazing purposes.

(2) EFFECT OF TREATMENTS ON THE COMPOSITION OF SWARDS AND PERSISTENCY OF SPECIES.

Most of the experiments were laid down on newly sown or comparatively young (one or two years old) pastures. The use of the three to five years' duration pasture rendered this desirable in order to ensure continuity for a few years. The scope of this report does not allow the individual pastures to be discussed in detail, nor is it particularly desirable to do so, as composition of the sward on arable land is largely governed by species and strains sown and subsequent management. It is well known that pastures "run out" rapidly in Canterbury. The recent researches of Levy and Davies, referred to earlier, have shown that strain of rye-grass has an important bearing on this rapid deterioration. Where rye-grass was the main constituent of the newly sown and younger pasture, generally speaking, it died out rapidly even under the better manurial treatments, although to a lesser extent on these than on the lesser effective treatments and the no-manure plots. Consequently the treatments were largely dependent on volunteer suckling clover and white clover, and such grasses as sweet vernal, brown top, Poa annua, and Yorkshire fog, as subjects for their action. The result was that, instead of increasing with continued application of fertilizers, responses were often less in the second year than in the first so far as grasses particularly were concerned.

Once again we desire to stress the fact that maximum effects from manures can be obtained only when a covering of high production and persistent species is present for the utilization of the manures applied. Lime, super, and lime plus super usually showed a greater influence on clovers than on grasses, although where rye-grass and cocksfoot and crested dogstail were present in fair amount lime plus super often had a marked influence on their production (Fig. 8, Appendix C).

Where potash effect was noted its main influence was on clovers. Nitrogen invariably stimulated grass-growth, and the greater the amounts of rye-grass, cocksfoot, and dogstail present the better was the response from it. It materially increased the growth of all grass species, but, as a rule, the material which it had to work on was of an inferior type. Suppression of clover-growth was a fairly constant feature accompanying the use of nitrogen, although, as stated previously, this did not appear to operate to a serious extent on those plots which had lime and phosphate in addition.

(3) SYSTEM OF GRAZING.

This falls under two categories—(*a*) intermittent controlled grazing of enclosed areas; (*b*) grazing under ordinary practice of the particular farm.

Unfortunately, only a small proportion of farmers were able to graze the enclosed section of the trial on a strictly intermittent system of utilization at an appropriate stage. Often the areas were too far from the homesteads and were neglected in busy times. Where proper control was exercised the pastures benefited considerably. Cocksfoot showed itself to be a grass which did well under such conditions. Where growth was allowed to become rank the pasture generally suffered in consequence, and rapid opening up took place. One of

the difficulties in stocking the fenced areas was to know just when to put stock on. At certain seasons the nitrogen plots had a good growth before the remainder of the plots were ready to graze. Usually stock were withheld until some of the slower-growing plots were ready, with the result that the nitrogen-treated plots were too rank for sheep and were neglected, while the other plots were grazed hard. So long as the nitrogen plots were grazed at a reasonably short stage of growth the sheep ate the herbage as readily as with any other treatment, more especially where the nitrogen crossed the super and super plus lime.

EFFECT OF TREATMENT ON PALATABILITY OF HERBAGE.

The lime plus super plots were almost always the most closely grazed (see Fig. 9, App. C), although it was sometimes difficult to distinguish between lime plus super and super alone from this point of view. Plots receiving lime alone were also closely grazed in a good many experiments. The closeness of grazing of nitrogen-treated plots was almost entirely governed by the stage of growth at which grazing occurred. When utilized at a young stage (2 in. to 3 in.) plots receiving nitrogen in addition to lime plus super, super, or lime were invariably well grazed. If grazing was delayed beyond this stage the nitrogen-treated plots were generally neglected, with the result that a big bulk of unconsumed roughage accumulated on them. Sheep were used for grazing in nearly all the experiments.

WHEN TO APPLY MANURES.

Time of application, except in the case of nitrogen, was not investigated particularly. There is abundant evidence, however, to indicate that early autumn application on established and well controlled pasture should be the best for lime and super. A certain amount of autumn, winter, and early spring growth will result, with a good response later in the season. If application of these manures is delayed until late winter or early spring there is likely to be a big stimulation during what is the normal high-production period, and difficulties of management and utilization are accentuated. As stated earlier, the most promising times at which to apply nitrogen which gives results within one or two months after application are late July or early August for early spring growth, and March to April for late autumn growth.

It is well to remember that manuring for increased production in naturally low-production periods is much better than manuring for increased production in naturally high-production periods. "Renovation" of pastures is a wrong practice. "Maintenance" of fertility and management from the time the pasture is sown is what should be the aim of every farmer.

THE APPENDICES.

Readers who are not particularly interested in the individual experiments are advised merely to look through the illustrations in the appendices. The results presented therein are for the guidance of farmers in the districts to which they refer. As a record for the guidance of farmers and those people whose duty it is to advise farmers the detailed results should be of considerable assistance.

Summary of Part II.

(1) The report discusses the results from observational experiments in which about 200 pastures were top-dressed with lime, superphosphate, potash, and nitrogen in the seasons 1928–29 and 1929–30.

(2) The combined lime plus super treatment has been outstanding in effect, definite responses being recorded in 94 per cent. of the trials. In 76 per cent. the responses are classed as good to excellent.

(3) Potash has had no visible effect in 83 per cent. of the trials, and does not appear to be an important factor in Canterbury, except in a few isolated places.

(4) Nitrogen caused increased growth of grasses in about 98 per cent. of the trials, being most beneficial when applied to ground treated with lime plus super. It almost invariably depressed clover-growth, although not to a serious extent when combined with the lime plus super application. The lime plus super plus nitrogen plots almost always had the best sward.

(5) Most of the pastures under trial ran out very rapidly. This is considered to be due to the poor strain of rye-grass in use.

(6) Where intermittent grazing was carried out effectively the pastures were improved. Under poor and inefficient utilization the pastures deteriorated more rapidly.

(7) Lime, super, and lime plus super generally had a marked effect on the palatability of the herbage.

(8) Application of lime and super in the early autumn is recommended in established pastures. Maintenance of good pastures, and not renovation of run-out pastures, is strongly recommended.

NOTES ON INTERPRETATION OF RESULTS AS RECORDED IN APPENDICES.

The first column indicates the number of the experiment as shown on the related section map. In columns 3 to 7 inclusive points are awarded to indicate the nature of the response to the treatment named at the head of each column.

0 = No visible response.	3 = Good response.
? = Doubtful response.	4 = Very good response.
1 = Slight response.	5 = Excellent response.
2 = Fair response.	

In some cases the effect of lime alone or super alone may not have been discernible with certainty, but lime plus super may have given a decidedly better response than either lime alone or super alone. In such cases one point followed by a plus sign (+) is given to the treatment in doubt.

The object of this system of recording results is to enable the information collected to be recorded concisely. In a number of cases both lime alone and super alone may receive 3 points each, whereas lime plus super will receive only 5. In such cases it may be taken for granted that the combined effect of the treatments is practically equal to the sum of the individual treatments.

Where other treatments—nitrogen or potash—are awarded points it may be taken as a rule that these points represent responses in

addition to those already scored for lime, super, or lime plus super. Points do not represent money values. On naturally good land a good response may indicate a high potential return, whereas on naturally poor land a good response may be obtained, which, however, may not be payable.

CLASSIFICATION OF SOILS.

It was not feasible to obtain chemical or mechanical analyses of the soils on which the experiments were conducted. An endeavour has been made to indicate the soil-type more or less according to the classification used by the Chemistry Section of the Department of Agriculture. It must be understood that the application of this system of classification here is entirely on surmise, except in a few cases where mechanical analyses have been made, and only major types are considered, each soil being placed in the class to which it is considered it falls nearest. The soil-types are shown in column 8 of the appendices.

The classes used are as follows :—

(*a*) Fine sandy silt : Contains more than 40 per cent. fine sand, from 20 to 50 per cent. silt, fine silt, and clay ; usually 10 to 35 per cent. silt and fine silt, and less than 5 per cent. clay.

(*b*) Fine sandy loam : Contains 20 to 50 per cent. silt and fine silt and clay ; usually 10 to 35 per cent. silt and fine silt, usually 5 to 15 per cent. clay.

(*c*) Silt : Contains more than 50 per cent. silt and fine silt ; less than 5 per cent. clay.

(*d*) Silt loam : Contains more than 55 per cent. silt and fine silt ; 5 to 25 per cent. clay.

(*e*) Loam : Contains more than 50 per cent. silt, fine silt, and clay ; and less than 55 per cent. silt and fine silt ; usually 15 to 25 per cent. clay.

(*f*) Clay loam : Contains more than 60 per cent. silt, fine silt, and clay ; 25 to 55 per cent. silt and fine silt ; 25 to 35 per cent. clay.

It is considered that the foregoing range of soil-types covers those met with in the experiments. Where the soil is stony this will be noted after the letter indicating the soil-type ; for example, a fine sandy silt with stones is described as "*a* (stony)."

APPENDICES.

A.—Responses to Treatment in Experiments north of Ashley River. (Map Section 1.)

Table 2.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response.	5 Lime plus Super Response.	6 Potash Response.	7 Nitrogen Response.	8 Soil-type.
	Waiau District.						
1	A. Baker	2	3	4	0	3	*e.*
2	J. Belton	2	2	4	1	3	*e.*
3	G. White	2	3	4	2	4	*e.*
4	MacDougall Bros.	2	1	3	0	3	*e.*
5	J. Brown	2	4	5	?	4	*c.*

Table 2—continued.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response	5 Lime plus Super Response	6 Potash Response.	7 Nitrogen Response.	8 Soil-type.
	Culverden District.						
6	E. Roberts	1	3	4	0	2	*a* (stony).
7	J. Black	1	4	5	0	Not used	*a* (stony).
8	H. A. Ingram	1	3	4	0	1	*c*.
9	J. V. Harrison (1)	1	1	3	0	3	*a*
10	J. V. Harrison (2)	3	3	5	0	4	*a*
	Cheviot District.						
11	Mrs Thomson, Spotswood ..	2	2	4	0	3	*e*.
12	A. G. Harrison, Spotswood ..	3	3	5	Not used	..	*e*.
13	D. Milne, Phœbe	3	1	3	0	2	*e*.
14	A McGiffert, Mina* ..	3	1	5	Not used	..	*e*.
15	G. W. Forbes	4	2	5	2	2	*e*.
16	J. Paton, Domett	3	1	5	0	4	*e*
17	E. Ayrton, Domett* ..	0	0	1	Not used	..	*e*
18	H. Geeson, Domett.. ..	3	2	4	0	3	..
	Waipara-Omihi District.						
19	H B. Inch	3	2	4	0	3	*d*.
20	E Foster	3	1	4	2	2	*d*
21	W. McAlpine	3	2	4	0	2	*d*.
22	W. Baxter, Spye	1	1	2	0	3	*d*
23	C. Harris	1	2	2	0	2	*d*
	Scargill District.						
24	G. W. Pannett	2	2	3	2	3	*c*.
25	H. V. Murray	1	2	3	0	2	*b*.
	Waikari-Hawarden District.						
26	H. Fincham	1	3	4	0	2	*e*.
27	H. Heasley, Hawarden ..	1	3	4	0	4	*a* (stony).
28	H. D. Burt, Hawarden ..	0	1	1	0	1	*f*.
29	W. E. Johnston, Woodgrove	1	3	4	0	3	*e*.
30	W. T. Earl, Woodgrove ..	1	1	2	0	2	*e*.
	Amberley-Leithfield-Sefton District.						
31	D. McLean, Amberley ..	0	0	1	0	1	*e*.
32	T. F. Croft, Amberley ..	1	2	3	0	2	*e*.
33	S. H. Gardiner, Amberley ..	1	5	5	0	3	*e*
34	McLean Bros , Amberley ..	1	1	2	0	1	*e*.
35	J. S. Russell, Leithfield ..	1	1	2	1	1	*e*.
36	F. J. Douds, Amberley ..	2	2	3	0	2	*e*.
37	C. King, Loburn (formerly H. Barker)	3	3	4	0	3	*f*.

*See haying trial report in this *Journal* for April, 1927.

COMMENTS ON TABLE 2.

Waiau District.—Lime plus super gave outstanding results. Where rye-grass was in abundance nitrogen gave good results, especially on plots receiving lime plus super. Potash had an influence mainly on clover-growth in two experiments. Experiments 1, 2, 3, and 4 are on downs

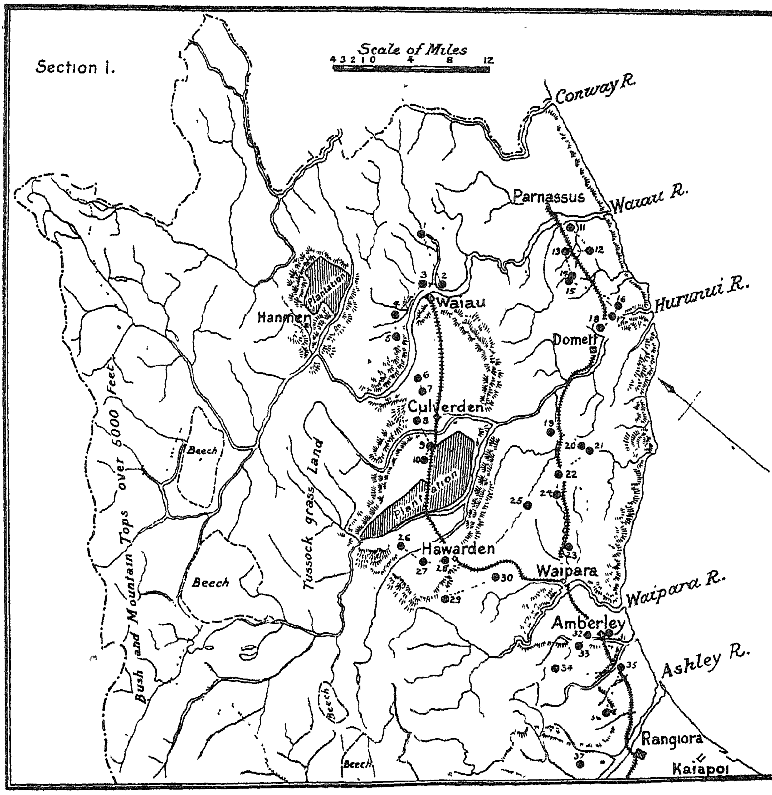

FIG. 3. MAP OF SECTION I, SHOWING LOCATION OF EXPERIMENTS NORTH OF ASHLEY RIVER.

Each experiment is represented by a numbered dot.

country, the soil being a loam. Experiment 5 is on river-flat country, the soil being of a silty nature. Most of the pastures have run out badly except on the best plots. The use of lime plus super should pay well in this district providing it is applied to good pastures.

Culverden District.—Lime plus super has proved a very satisfactory combination, and on Experiment 10 nitrogen gave very good results on the lime and super plots. In Experiments 6, 8, 9, and 10 lime plus super plus nitrogen were the best plots. Stock showed marked preference for lime plus super in most cases. Lime plus super should pay well in this district, particularly if used at time of sowing pasture.

Cheviot District.—With the exception of Experiment 17, lime is of outstanding effect in this district. Super alone gave slight to fair results, which are considerably enhanced when super is used on limed ground. It is not a question of whether lime plus super pays in this district. They are both absolutely essential to the production of pasture. Potash had no visible effect except on Experiment 15, and then only on limed ground. Most of the experiments are on downs country. It is now six years since Experiment 14 was laid down. The effect of lime was still very marked in the spring of 1929 (see Fig. 4).

Waipara-Omihi District.—In these experiments a good lime response is indicated. Generally speaking, lime plus super is better than either lime or super alone, and the best plot is lime plus super plus nitrogen in all cases. Potash gave fair results in Experiment 20, this being first noticed in the autumn of 1930. In Experiment 21 the response to lime plus super is very good, but the pasture is a tussock-danthonia one, and suckling clover has been responsible for the chief response, which is not likely to be payable.

Scargill District.—Responses were not very outstanding, although lime plus super gave good results in both experiments. Response from potash was not noticeable in Experiment 24 until March, 1930, and then its effect was on red clover growth.

FIG. 4. EXPERIMENT ON FARM OF A. MCGIFFERT, MINA, CHEVIOT DISTRICT (NO. 14).

On left, no treatment; on right, lime carbonate, at 1 ton per acre, applied in winter of 1924. Photo taken in October, 1928, when the lime and superphosphate plots had a much denser sward of rye-grass and clover and were better grazed than the no-treatment plot.

Waikari-Hawarden District.—Super, and lime plus super gave satisfactory response in three trials only. Nitrogen was effective only when a reasonable amount of rye-grass was present. Experiments 27, 28, and 30 have been ploughed up on account of the pasture having run out. Experiments 28 and 30 are on soil which has a reputably small phosphate-response on any crop.

Amberley-Leithfield-Sefton District.—The almost entire absence of response in Experiment 31 is largely due to the very inferior pasture. No outstanding response occurred from lime except in Experiment 37. Results from super are not striking except in Experiment 33. Lime plus super was generally superior to lime or super alone. The relatively poor nitrogen response is no doubt due to a comparatively poor type of pasture in some cases. Experiments 31 and 34 have been ploughed up.

SUMMARY OF EXPERIMENTS NORTH OF ASHLEY RIVER.

Lime.—Only three out of the thirty-seven experiments failed to give a noticeable response from lime. In one of the three (No. 31) lime plus super gave a slight effect. The most striking responses occurred in the Cheviot district, although good responses also occurred in the Omihi Valley.

Superphosphate.—Only two cases are recorded where super did not show a benefit at some stage or other. Most districts gave fair to good responses, except in the Cheviot and Omihi Valley districts, where responses were generally slight to fair.

Lime plus Superphosphate.—With one exception, the lime plus super combination was superior to lime alone or super alone. In a large number of experiments a marked superiority in palatability as evidenced by closer grazing was apparent.

Potash.—Six experiments out of the thirty-seven showed slight to fair responses to potash. These results indicate that potash is not a serious limiting factor so far as production of volume of herbage is concerned.

Nitrogen.—Nitrogen caused increased growth at some period in all trials. The results can be considered good only where a good percentage of rye-grass is present in the sward. In nearly all the experiments the best results with nitrogen were obtained on ground treated with lime plus super.

B.—Responses to Treatments in Experiments between Ashley and Rakaia Rivers. (Map Section 2.)

Table 3.

1	2	3	4	5	6	7	8
Reference No. on Map.	Farmer.	Lime Response.	Super Response.	Lime plus Super Response.	Potash Response.	Nitrogen Response.	Soil-type.
	Rangiora-Fernside-Waikuku District.						
1	Stoker Bros., Waikuku ..	1+	2	3	0	2	*c.*
2	C. Leech, Rangiora ..	1	2	3	0	3	*d.*
3	W. Stalker, Rangiora* ..	1	2	3	Not used	Not used	*d.*
4	J. F. Dawson, Fernside ..	3	3	4	0	3	*a* (stony).
5	Doak Bros., Rangiora ..	2	3	4	0	3	*d* (peaty).
6	W. Power, Fernside ..	1	1	2	0	2	*a* (stony).
	Kaiapoi-Ohoka-Mandeville District.						
7	J. Thacker (formerly E. Fear), Kaiapoi*	0	4	4	Not used	Not used	*c.*
8	J. D. McMullan, Kaiapoi ..	2	3	4	0	0	*d.*
9	M. Williams (1), Ohoka ..	1+	4	5	0	3	*d.*
10	M. Williams (2), Mandeville ..	1+	2	3	0	2	*a.*
	Cust - West Eyreton District.						
11	S. Smith, Cust (1)	3	1	4	0	2	*c.*
12	S. Smith, Cust (2)	Growth too rank for observation					*d* (swampy).
13	R. L. Anderson, Bennett's Jun.	1	1	2	0	1	*b* (stony).
14	F. Sheat, Horreville ..	0	0	0	0	2	*c.*
15	J. E. Burns, Horreville ..	1	1	3	0	3	*a* (stony).
16	W. S. Busch	1	1	3	0	2	*a* (stony).

Table 3—continued.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response.	5 Lime plus Super Response.	6 Potash Response.	7 Nitrogen Response.	8 Soil-type.
	Oxford District.						
17	W. J. Skurr, Carlton ..	3	2	4	0	3	*a* (stony).
18	J. J. Skurr	3	3	5	2	3	*d.*
19	A. Baxter	3	3	5	0	3	*c.*
20	H. G. Cross (2)	3	3	5	0	3	*a* (stony).
21	H. G. Cross (1)	3	4	5	0	3	*b* (stony).
22	A. A. Fantham	3	3	5	0	2	*e.*
	Aylesbury-Halkett-Kirwee District.						
23	J. D. Henderson, Halkett ..	2	4	5	0	4	*b.*
24	R. Henderson, Halkett ..	1	1	3	0	3	*c.*
25	M. V. Davis, Aylesbury ..	1+	1+	1	0	2	*a* (stony).
26	A. Manson, Kirwee ..	1	1	2	0	4	*a.*
27	J. D. Penny, Kirwee ..	2	1	3	0	3	*a.*
	Lincoln-Springston District.						
28	Pearson Bros., Lincoln ..	2	1	3	?	3	*c.*
29	P. V. Bailey, Springston ..	1	2	3	0	2	*c.*
30	C. N. P. Powell, Springston ..	1+	3	5	0	3	*c.*
31	J. W. Kime (1), Springston ..	0	0	0	0	1	*a* (stony).
32	J. W. Kime (2)	0	0	0	0	1	*a* (stony).
	Motukarara District.						
33	H. Nutt, McQueen's Valley ..	1	1+	2	1	3	*d.*
	Springfield-Russell's Flat District.						
34	R. M. Johnston, Mount Torlesse	2	2	3	?	3	*d.*
35	E. P. Rushton, Springfield ..	3	3	5	0	3	*c* (stony).
36	W. McIlwraith, Russell's Flat	4	2	5	0	2	*c.*
37	D. Doody, Russell's Flat ..	3	2	5	3	3	*c.*
38	S. H. Amyes, Springfield ..	1	1	2	0	2	*d.*
	Sheffield-Annat District						
39	L. T. Wright, Annat ..	2	4	5	0	3	*c* (stony).
40	J. H. Jebson, Sheffield ..	3	2	5	0	2	*c.*
41	D. J. Hawke, Sheffield ..	3	2	5	1	4	*c.*
42	R. J. Cullen, Sheffield ..	2	4	5	0	3	*c* (stony).
	Hororata District.						
43	F. N. Wright	0	1	1	0	2	*b* (stony).
44	W. R. Oliver	1	2	3	0	3	*e.*
45	J. Ballagh	1+	1	3	1	3	*e.*
46	Bruce Bros., Coleridge Road ..	2	4	5	3	3	*a* (stony).
	Te Pirita-Mead Settlement-Bankside District.						
47	A. Craig, Te Pirita	1+	3	4	0	3	*a* (stony).
48	E. Duncan (1), Te Pirita ..	1	2	3	0	2	*a* (stony).
49	E. Duncan (2), Te Pirita ..	0	1	1	0	1	*a* (stony).
50	J. Kelso, Bankside	2	2	3	1	3	*a* (stony).
51	W. Shellock, Mead	3	3	5	3	3	*c.*

COMMENTS ON TABLE 3.

Rangiora-Fernside-Waikuku District.—Both lime and super gave consistent, though relatively small, results in general. Lime plus super was invariably better than either lime or super alone. Nitrogen responses were the best where rye-grass was fairly abundant. In Experiment 1 lime alone showed no visible effect, but lime plus super was better than super.

Kaiapoi-Ohoka-Mandeville District.—Super alone gave striking results in this district (Fig. 6). Lime plus super, with the exception of Experiment 7, was better than super. Nitrogen responses occurred where fair amounts of grass were present. Experiment 10 has been ploughed up, as the pasture was badly run out.

Cust-West Eyreton District.—No outstanding responses occurred except in Experiment 11, where lime showed itself to be a very important factor. The pasture ran out very quickly and white clover became

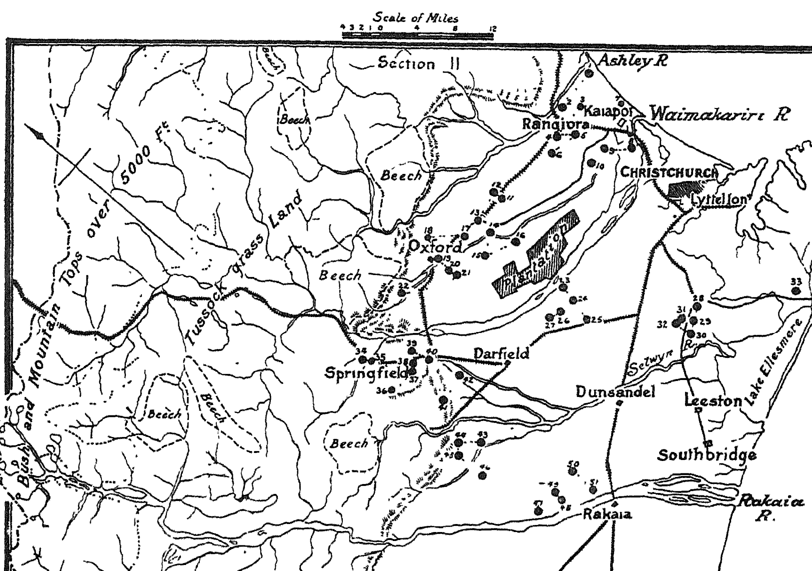

FIG. 5. MAP OF SECTION 2, EXPERIMENTS BETWEEN ASHLEY AND RAKAIA RIVERS.

dominant on the lime plots. In Experiment 14 the growth was not well controlled and observations were difficult. Experiment 15 is on very light land. Nitrogen had a marked effect on cocksfoot, especially on the lime-plus-super-plus nitrogen plot.

Oxford District.—The responses to lime and super in this district are outstanding, especially when the two are combined. In Experiment 18 potash had an influence in the second season. Nitrogen responses were generally good, but, in common with the majority of trials, the growth on the nitrogen plots was neglected. No doubt this was due to the growth being too long when the areas were stocked.

Aylesbury-Halkett-Kirwee District.—The soils in this district are, generally speaking, very light, and pasture runs out rapidly. Experiment 25 has been ploughed up. Lime plus super proved superior to lime and super

alone, but, with the exception of Experiment 23, no outstanding responses were obtained. Nitrogen did well where good grasses were present. Where good grasses were absent hair-grass responded freely to nitrogen.

Lincoln-Springston District.—In the first three experiments lime and super gave slight to good results. Lime plus super has proved superior to either lime or super alone. Experiments 31 and 32 were on poor, run-out pasture, consisting mainly of hair-grass and goose-grass. Both have been ploughed up. Nitrogen response was more or less proportionate to the amount of rye-grass and cocksfoot present.

Motukarara District.—Responses here were small. The marked feature of this experiment was the big improvement in the enclosed area, notably in cocksfoot, which resulted from good rotational grazing.

FIG 6. EXPERIMENT ON FARM OF M. WILLIAMS, OHOKA (NO. 9).

The effect of super on growth of white clover, as seen in foreground, was very marked in this experiment.

Springfield - Russell's Flat District.—Lime and super were consistent, with good to excellent results when used together. Lime and phosphate are essential to good pasture-production in this district, and their use must be highly paying on good pasture. In Experiment 37 potash gave good results when used with lime and super. Nitrogen thickened up the sward considerably when used with lime plus super. On Mr. Duncan's farm a very good result was obtained from the use of 5 cwt. of ground limestone in conjunction with phosphate in a trial carried out by him.

Sheffield-Annat District.—Here again lime plus super is essential to successful pasture growth. In Experiment 41 potash showed up slightly in the second season. The plots receiving lime and super plus nitrogen were invariably the best. Experiment 42 has been ploughed up.

Hororata District.—Experiments 44 and 45 are on the clay downs of this district In Nos. 44 and 45 lime plus super gave good results. Experiment 46 is on the lighter land along the road to Lake Coleridge. The results in this experiment were remarkable. All treatments showed responses.

Te Pirita - Mead Settlement - Bankside District.—Lime and super gave consistent results. Experiments 48 and 49 were on very light country, and the application of manures could not be payable. These plots were abandoned. Experiment 51 gave good results from all treatments in the first season. The pasture has now run out.

SUMMARY OF EXPERIMENTS BETWEEN ASHLEY AND RAKAIA RIVERS.

Lime.—Of the fifty-one experiments recorded only six failed to show a response to lime. In the remaining forty-five lime alone showed a definite response, or (in seven experiments) lime plus super was definitely better than super. The responses were most outstanding in the Cheviot, Springfield - Russell's Flat, and Sheffield - Annat districts.

Superphosphate.—Benefits from the use of super were apparent in forty-eight of the fifty-one experiments. In two of these the effect could be noticed only in superiority of lime plus super over lime. The best responses occurred in the Kaiapoi-Ohaka-Mandeville, Oxford, Sheffield-Annat, and Springfield-Russell's Flat districts.

Lime plus Superphosphate.—Responses to lime plus super were observed in forty-eight of the experiments, and in all of these except four the lime-plus-super combination was superior to super or lime alone. The most marked results were obtained where the lime response was greatest.

Potash.—Responses to potash occurred in eight experiments. In two others a doubtful response was recorded. The response areas are not confined to particular districts. The most noticeable results occurred in Experiments 46 and 51, both of which were on land of alluvial formation. Experiment 46 was on light stony land.

Nitrogen.—Nitrogen affected growth in all the experiments but one. In the absence of rye-grass, cocksfoot, or dogstail the response was usually small. When applied to ground treated with lime plus super the results were invariably most effective, and, except in a few cases, clovers were not suppressed on plots receiving lime, super, and nitrogen. Usually nitrogen-treated plots showed neglected growth This may be attributed to delaying stocking until growth was too far advanced.

C.—Responses to Treatments in Experiments between Rakaia and Rangitata Rivers. (Map Section 3.)

Table 4.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response.	5 Lime plus Super Response.	6 Potash Response.	7 Nitrogen Response.	8 Soil-type.
	Rakaia-Somerton-Hatfield District.						
1	J. Stewart, Rakaia ..	2	2	4	0	3	*c.*
2	J F. Langley, Somerton ..	2	2	3	0	3	*b.*
3	W. Boag, Hatfield	3	2	4	0	4	*b.*
	Sherwood-Lauriston-Winchmore District.						
4	W. Goodwin (now J. Cretney), Lauriston	3	3	5	0	3	*a.*
5	F. Amos (now V. W. Boag), Lauriston	3	3	5	0	2	*a.*

Table 4—continued.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response.	5 Lime plus Super Response.	6 Potash Response	7 Nitrogen Response.	8 Soil-type.
	Sherwood-Lauriston-Winchmore District—continued.						
6	H. J. Crothers, Sherwood ..	4	2	5	0	4	*a*.
7	W. Letham, Sherwood ..	4	3	5	0	3	*a*.
8	H. Morris, Winchmore ..	2	1	3	0	3	*a* (stony).
	Mount Hutt-Methven-Upper Winchmore District.						
9	D. M. Christie, Mount Hutt ..	?	?	?	?	2	*b* (stony).
10	D. Campbell, Methven ..	1+	1+	2	0	2	*b* (stony).
11	J. Watson, Upper Winchmore	1	1	3	0	3	*a* (stony).
12	R. N. Elliott, Methven .	1	1+	2	0	2	*b*.
	Springburn-Staveley District						
13	S. A. Allen, Springburn ..	3	1+	4	0	2	*a* (stony).
14	G. McFarlane, Springburn ..	2	1	3	0	3	*a* (stony).
15	R. A. Hobbs, Springburn ..	3	3	5	0	3	*b* (stony).
16	W. Gundry, Staveley ..	2	3	5	0	3	*d*.
17	G. Fittock, Staveley ..	1	3	4	0	2	*d*.
18	A. R. Andrews, Staveley ..	1	1	2	0	2	*d*.
	Mount Somers District.						
19	T. Rutherford	1	1	2	0	2	*b*.
20	J. Thomson	2	2	4	0	3	*a* (stony).
21	Stephen Bros.	2	2	4	0	3	*a* (stony)
22	H. N. Armstrong	3	2	4	0	2	*a* (stony).
	Mayfield-Lismore-Ruapuna District.						
23	R. Oakley, Mayfield ..	3	2	5	1	3	*b*.
24	S. B. McLauchlan, Lismore ..	3	2	5	0	3	*a* (stony).
25	W. J. Imrie, Mayfield ..	2	3	5	0	2	*a* (stony).
26	G. W. Ross (2), Ruapuna ..	2	2	3	0	3	*a* (stony).
27	G. W. Ross (1), Ruapuna ..	3	2	4	0	2	*a* (stony).
28	J. H. Boaler, Ruapuna ..	3	3	5	0	4	*a* (stony).
	Carew-Ealing District.						
29	A. Pithie, Carew	3	3	4	0	3	*a*.
30	J. Cormack, Carew ..	2	2	3	0	2	*a* (stony).
31	J. Ritchie, Carew	2	2	3	0	3	*a* (stony).
32	J. Withell, Ealing	2	2	5	0	3	*a*.
33	B. Withell, Ealing	3	3	5	0	3	*a* (stony).
34	Reith Bros., Ealing ..	2	2	3	0	3	*a*.
	Hinds District.						
35	W. Frampton	2	2	3	0	4	*a* (stony).
36	C. Chisnall	3	2	4	0	3	*a* (stony).
37	T. Wells	3	2	4	0	2	*a* (stony).
38	E. M. Watson	1	1	2	0	3	*a* (stony).
39	J. Bagrey	1	1	3	0	2	*a* (stony).
40	S. Rickards	3	2	4	0	3	*a*.
	Eiffelton-Maronan-Laghmor District.						
41	J. Findlay, Eiffelton ..	3	1	4	0	2	*d* (peaty).
42	H. L. Barker, Maronan ..	2	2	3	0	4	*a* (stony).
43	S. Crossan, Laghmor ..	3	2	4	0	3	*c*.

Table 4—continued.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response.	5 Lime plus Super Response.	6 Potash Response.	7 Nitrogen Response.	8 Soil-type.
	Seaview-Riverside-Wakanui-Newlands-Seafield-Pendarves Dromore District.						
44	H Brown, Seaview.. ..	3	3	5	0	3	*c.*
45	E. Bonnington, Riverside ..	4	2	5	0	3	*a* (stony).
46	A. Bennett, Riverside ..	2	1	3	0	2	*b.*
47	W. J. Doak, Wakanui ..	?	?	?	?	?	*c.*
48	A. Amos, Wakanui ..	1	2	3	0	4	*c.*
49	H Bonifant, Wakanui ..	1	1	2	0	2	*a* (stony).
50	J W. Butterick, Wakanui ..	2	2	3	0	3	*a* (stony)
51	W. A. Beggs, Newlands ..	4	2	5	0	4	*a* (stony)
52	A Gregory, Seafield ..	2	4	5	0	4	*b.*
53	A Bennison, Seafield ..	3	3	5	0	4	*a* (stony).
54	G. Todd, Seafield	1	1	1	0	2	*a.*
55	A. P. Bruce, Pendarves ..	3	2	5	0	4	*a* (stony).
56	J. W. Watson, Pendarves ..	2	2	3	0	3	*a* (stony).
57	F. Ironside, Pendarves ..	3	3	4	0	3	*b.*
58	P. Doig, Pendarves . ..	2	2	4	0	4	*b.*
59	H J. Wilson, Dromore ..	3	2	4	0	2	*a* (stony).

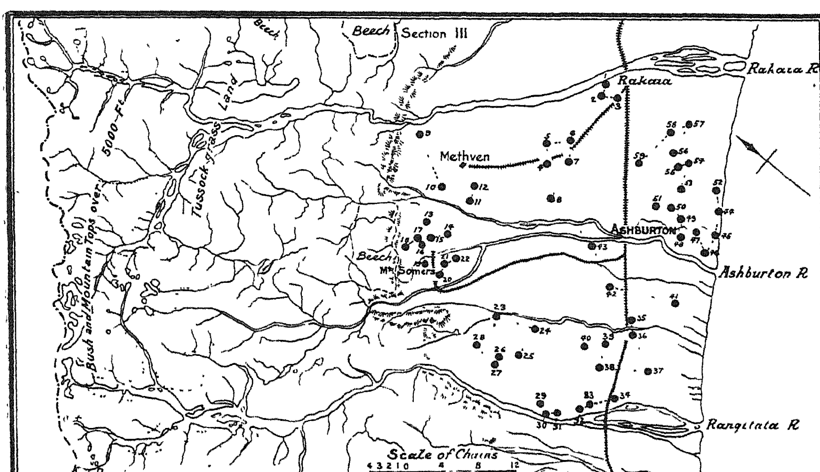

FIG. 7. MAP OF SECTION 3, EXPERIMENTS BETWEEN RAKAIA AND RANGITATA RIVERS.

COMMENTS ON TABLE 4.

Rakaia-Somerton-Hatfield District.—Both lime and super benefited growth, particularly of clovers, with better results in each case where used together. Potash had no effect. Nitrogen stimulated grass-growth where present, but tended to suppress clovers, though not seriously when used with lime plus super. The pastures in Experiments 1 and 2 have become depleted of rye-grass, which is being replaced by hair-grass.

Sherwood-Lauriston-Winchmore District.—The effect of lime and lime plus super was outstanding in Experiments 4 to 7. Marked preference

for the lime-plus-super plots was shown by stock. Potash had no effect on yield or stock-grazing. Nitrogen stimulated grasses, but tended to suppress clover-growth. This suppression of clover was least noticeable where the nitrogen was applied to plots treated with lime plus super. The sward was invariably best on the lime-plus-super-plus-nitrogen plots. Lime is a very important factor in the Sherwood-Lauriston district, and farmers cannot afford to neglect the use of lime on grassland as a foundation for the use of the other manures. (Fig. 8.) Experiment 4 is of particular interest in that clover is now much stronger and thicker on the plot receiving lime plus nitrogen than on the lime alone plot. Lime plus super plus nitrogen is not so good, however, in clover content as lime plus super, although the clover content of the former is quite good.

Mount Hutt - Methven - Upper Winchmore District.—All trials in this group were laid down in July, 1929. The combination of lime plus super gave decided results in three experiments, and it is probable that the effect will be intensified in the present season. Experiment 10 has had to be abandoned on account of grass-grub attack in the pasture.

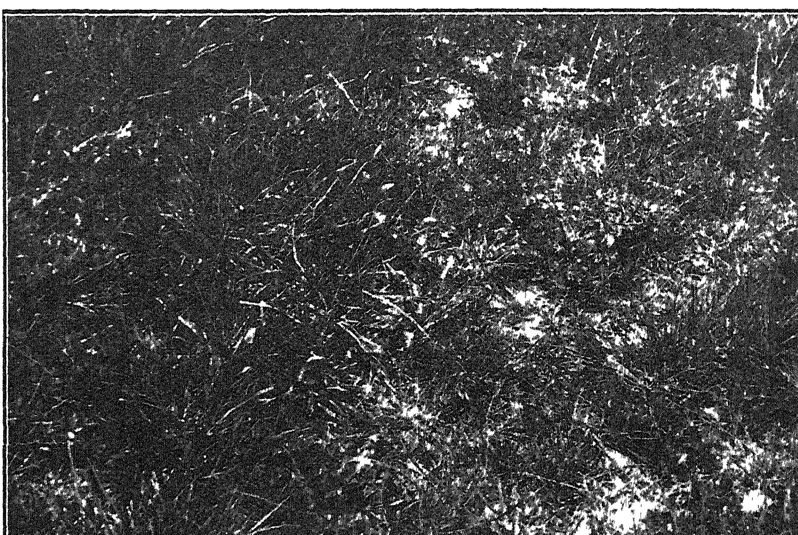

FIG. 8. EXPERIMENT ON FARM OF W. S. LETHAM, SHERWOOD (NO. 7).

On left lime and super, applied in winter of 1928; on right, no manure. Photo taken in November, 1929.

Springburn-Staveley District.—This area receives a heavier rainfall than most of Canterbury, the average fall being between 40 in. and 50 in. Lime plus super was outstanding in effect in five of the six trials. Stock showed a marked preference for these plots. (Figs 9 and 10.) In Experiment 13 super caused no visible difference, but lime plus super was superior to super. On the heavier type of soil (*d*), nitrogen stimulated grass-growth without appreciably affecting clovers. Potash did not have any apparent effect in any experiment.

Mount Somers District.—With the exception of Experiment 19, the responses to lime plus super were very good, and plots receiving this treatment and nitrogen in addition have been markedly better grazed by stock. The nitrogen response was good where reasonable quantities of the better grasses were present. Potash had no apparent effect.

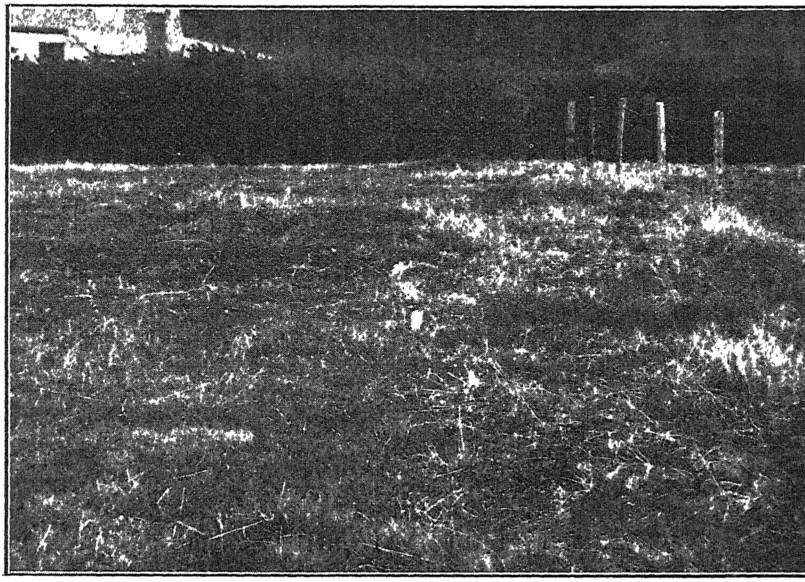

FIG. 9. EXPERIMENT ON FARM OF W. GUNDRY, STAVELEY (NO. 16).

This is a fifteen-year-old pasture. Left of pegs, lime and super, and lime, super, and nitrogen plots, applied in winter of 1927, right of pegs, no manure. Note closer grazing and stimulation of herbage on treated plots. Photo taken in November, 1928.

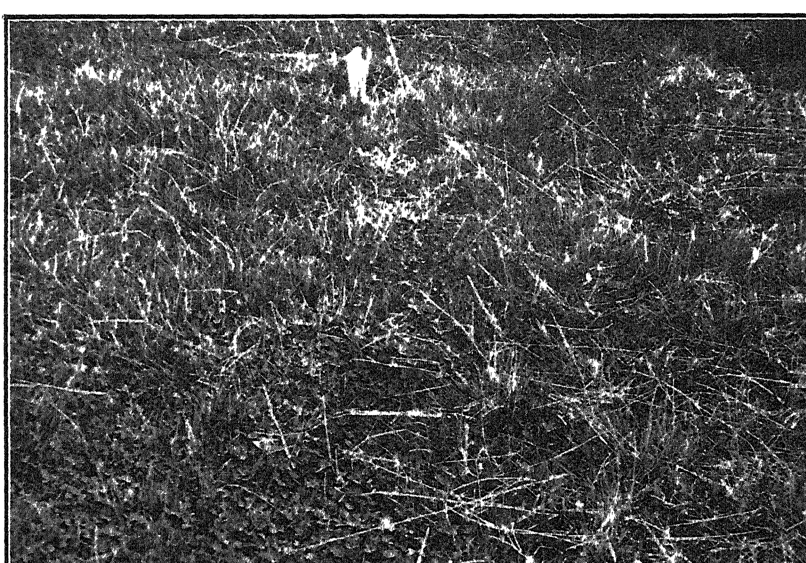

FIG. 10. CLOSE-UP VIEW OF PART OF TURF SHOWN IN FIG. 9.

Mayfield-Lismore-Ruapuna District.—The combination of lime plus super was consistently good to excellent, and superior to either lime or super alone. Potash had a slight effect on limed ground in Experiment 23. Nitrogen was consistently fair to good in its effect on grass-growth, without serious reduction of clovers on ground treated with lime plus super. The land in the main is light and the pastures contain much sweet vernal, rye-grass going out rapidly, due no doubt to a large extent to the strain of rye-grass used. The rainfall in this district is about 35 in.

Carew-Ealing District.—Responses to lime and super occurred in all these experiments, the combination of the two being decidedly superior to either alone. The lower rainfall of this district as compared with the previous one detracted somewhat from the degree of response. Potash had no effect. Nitrogen was invariably effective, but as the pastures contain relatively little cocksfoot and rye-grass the effect was on browntop, fog, and sweet vernal. Generally speaking, clovers were suppressed by the nitrogen, although to a least extent on the lime-plus-super-plus-nitrogen plots, which invariably have the best sward.

Hinds District.—The same remarks apply as in the case of the Carew-Ealing District.

Eiffelton-Maronan-Laghmor District—Three distinct soil-types are here represented. In all cases lime plus super proved a good combination. The nitrogen response was least on the most fertile soil.

Seaview-Riverside-Wakanui-Newlands-Seafield-Pendarves-Dromore District.—Experiment 47 was abandoned after the first season, as the pasture was badly affected as a result of "getting away." Experiment 54 was abandoned after eight months on account of its being almost pure danthonia, which got badly out of control. The remaining experiments were on soils varying in type. Type of soil did not appear to materially affect the response to treatments, and lime and super gave from good to excellent responses, except in Experiment 49, in which the response was fair only. Potash had no visible effect in any trial. As usual nitrogen was effective in stimulating grass-growth. The degree of suppression of clovers varied on the different experiments, but, generally speaking, the lime plus super plus nitrogen has produced the best sward.

SUMMARY OF EXPERIMENTS BETWEEN RAKAIA AND RANGITATA RIVERS.

Lime.—Of a total of fifty-nine experiments in this area all showed definite responses to lime, except two which are recorded as doubtful. Most of the trials gave fair to good responses, the most outstanding results occurring in the Sherwood-Lauriston district. All districts, except Mount Hutt-Methven (in which the trials have been down for one year only), have a fair proportion of areas where good responses are recorded.

Superphosphate—All experiments, except two which are in the doubtful class, showed responses to super, the best results having occurred in the districts nearer the Alpine ranges, where rainfall is usually higher. It is extremely doubtful whether the top-dressing of established pasture with super is profitable on some of the lighter and drier soils, such as those in the Seafield and Hinds districts. Reference was made to these soils in the general discussion.

Lime plus Super.—In every experiment except three the combination of lime plus super gave better results than either lime or super alone. As a rule the lime plus super plots were the most palatable to stock.

Potash.—Only one slight and two doubtful responses to potash are recorded.

Nitrogen.—The use of nitrogen resulted in responses in all cases. Usually the nitrogen had only sweet vernal, hair-grass, and brown-top on which to act after the pastures were one to two years old. Suppression of clover was common, but on the lime-plus-super-plus-nitrogen plots the sward as a whole was usually the best of all plots. More persistent strains of perennial rye-grass should assist materially in pasture-production after the first season in the life of the pastures in this district.

D.—Responses to Treatments in Experiments situated between Rangitata and Waitaki Rivers. (Map Section 4.)

Table 5.

1	2	3	4	5	6	7	8
Reference No. on Map.	Farmer.	Lime Response	Super Response	Lime plus Super Response	Potash Response.	Nitrogen Response	Soil-type
	Geraldine-Woodbury-Arundel-Orari-Pleasant Valley-Hilton District						
1	J. Charles, Arundel.. ..	3	3	5	1	3	*a* (stony).
2	J. Wooding, Woodbury ..	4	3	5	2	3	*e*
3	K. McKenzie, Geraldine ..	2	4	5	0	2	*c*.
4	R. Volckman, Te Moana ..	1	1	1	0	2	*f*.
5	R. McLeod, Geraldine ..	2	2	3	0	3	*b* (stony)
6	J. Gresham, Pleasant Valley..	1	2	3	?	2	*f*.
7	F. Charles, Hilton	3	3	5	2	3	*f*.
8	Muff Bros., Orari . ..	2	4	5	?	3	*c*.
	Fairlie District.						
9	Armitage and Jennings, Sherwood Downs	2	2	4	0	4	*f*.
10	A. Campbell, Melville Downs	4	3	5	0	3	*f*.
11	E. Goodwin, Fairlie* ..	2	4	5	3	Not used	*e* (stony).
12	J. Scarlett, Cattle Valley ..	3	3	4	0	3	*f*.
	Albury District.						
13	O. Oakley, "The Brothers"..	?	0	?	0	3	*f*.
14	R. Irving	?	2	2	0	3	*f*.
15	J. Macauley	2	4	5	0	3	*e*.
	Pleasant Point-Sutherlands District.						
16	W. Talbot, Opuha	3	2	4	0	3	*f*.
17	C. G. Lyons, Hanging Rock ..	2	2	3	0	2	*c*.
18	R. G. Clelland, Sutherlands ..	3	3	5	0	3	*f*.
	Cave-Cannington District.						
19	A. E. Gillingham, Cave ..	1	1	2	0	3	*e*.
20	J. Scott, Cannington ..	1	0	1	0	2	*d* (stony).
21	D. Priest, Cannington ..	4	3	5	0	3	*f*.
	Waitohi District.						
22	D. H. Paterson*	4	2+	5	0	Not used	*d*.
23	L. V. Talbot	?	2	2	0	2	*f*.
24	G. A. Davey	2	1+	3	0	3	*e*.
25	J. Lyons	2	1+	2	0	4	*d*

* Haying Trial—Part IV.

Table 5—continued.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response.	5 Lime plus Super Response.	6 Potash Response.	7 Nitrogen Response.	8 Soil-type.
	Milford-Clandeboye District.						
26	A. Botting, Temuka ..	?	?	?	0	3	*d.*
27	G. McFarlane, Winchester ..	2	5	5	?	4	*d.*
28	J. Oliver	3	3	4	?	3	*d.*
29	S. McCully Estate, Milford ..	1+	1+	2	0	3	*d.*
30	T. Sherift, Clandeboye ..	1	1	1	0	3	*d.*
	Seadown-Levels District.						
31	M. J. Fitzgerald, Arowhenua	1	1	2	0	3	*d.*
32	C. L. Orbell, Rosewell ..	4	3	5	0	3	*f.*
33	W. H. Orbell (2), Levels ..	?	?	?	0	3	*e.*
34	W. H. Orbell (1)	2	3	4	0	2	*e.*
	Claremont-Fairview-Salisbury District.						
35	P. R. Talbot, Claremont ..	4	3	5	?	4	*f.*
36	A. P. Kelland, Fairview ..	2	1	3	0	3	*f.*
37	W. J. Black, Salisbury ..	2	2	3	0	2	*f.*
	Pareora District.						
38	A. S. Elworthy	2	2	3	0	3	*f.*
39	A. Stewart Estate	1	?	1	0	3	*f.*
40	G. Sides	1	2	3	0	2	*f.*
	Otaio District.						
41	W. J. Beattie	?	0	?	0	2	*f.*
42	J. Stowell	3	4	5	0	3	*d.*
43	S. Powell	2	3	4	0	3	*f* (ironstone).
44	J. Hall	1	0	1	0	2	*f.*
	Makikihi-Hunter-Hook District.						
45	H. Miles, Makikihi	2	2	3	0	3	*f*
46	J. Armstrong, Hunter ..	?	?	?	0	2	*e.*
47	W. Miller, Hunter	0	0	0	0	2	*e* (stony).
48	H. Judge, Makikihi ..	1	1	1	0	3	*e.*
49	H. H. Meyer, Hook ..	1	1	2	?	3	*f.*
	Waihao-Forks District.						
50	B. Moyle	2	3	4	?	3	*f.*
51	I. Macdonald	1	1+	2	0	2	*f.*
	Waimate-Glenavy District.						
52	H. Ruddenklau, Waimate ..	2	3	4	0	3	*d.*
53	A. Grant, Waimate.. ..	2	1	3	?	3	*d*
54	R. K. Ireland	4	2	5	0	4	*a* (stony).

COMMENTS ON TABLE 5.

Geraldine-Hilton District.—Effect from lime was apparent on all trials, although on five of the eight the results were slight to fair only. Super effect is recorded on all experiments, and was outstanding on five. Lime plus super proved superior to lime alone or super alone in all except

Experiment 4. The responses to potash were not marked, and were most in evidence where potash application crossed limed ground. Nitrogen effect was most marked in spring growth, and thickened the grass sward considerably on the lime-plus-super-plus-nitrogen plots. Cocksfoot responded to it to a marked extent in Experiment 7

Fairlie District.—Lime plus super was outstanding in this district. Lime alone and super alone each gave fair to very good responses. The potash response was high in Experiment 11, but not noticeable in other experiments. Nitrogen, as usual, gave good results on the grasses.

Albury District—Experiment 13 is on pasture consisting mainly of brown-top. Experiments 14 and 15 were laid down in 1929, so that it is rather early to comment on the lime response in Experiment 14, although it is already very distinct in Experiment 15.

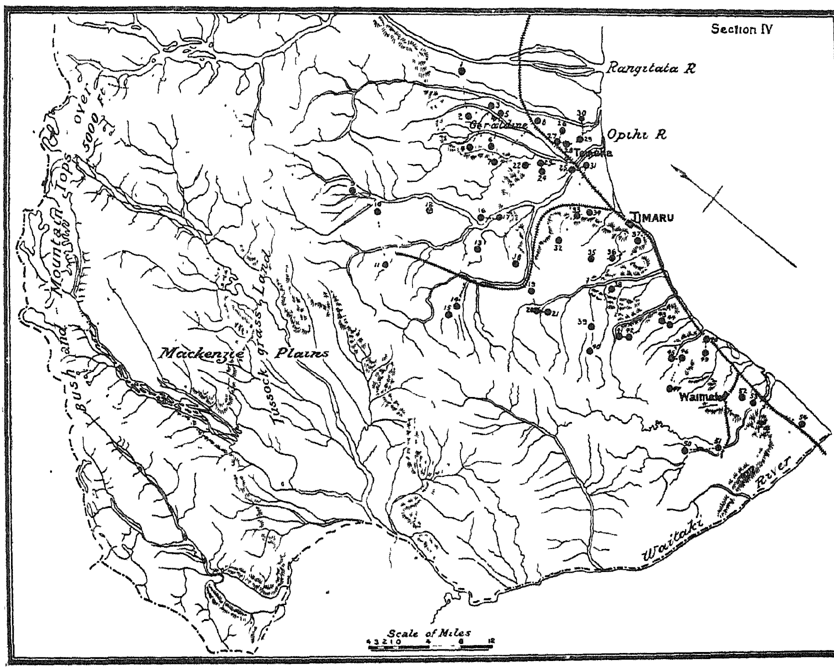

FIG. 11. MAP OF SECTION 4, EXPERIMENTS BETWEEN THE RANGITATA AND WAITAKI RIVERS.

Pleasant Point - Sutherlands District.—Lime plus super was outstanding in effect. In Experiment 16 the nitrogen is keeping rye-grass in, whereas brown-top is the dominant grass in the other treatments.

Cave-Cannington District.—The only outstanding response from lime, super, and lime plus super has been in Experiment 21. Experiment 20 was on old brown-top pasture. Responses in Experiment 19 did not how up until the second season.

Waitohi District.—Experiment 22 was outstanding in the response to lime. (A photograph of the plots will appear as Fig. 17, in Part IV.) Otherwise responses were not outstanding, except in the case of nitrogen in Experiment 25.

Milford-Clandeboye District.—Experiments 26 and 30 were laid down in 1929, so that it is rather early to draw conclusions. Experiments 27 and 28 were the most outstanding so far as responses to lime plus super are concerned. Nitrogen was consistently effective in promoting grass-growth.

Seadown-Levels District.—Experiments 31 and 33 were laid down in 1929. Experiment 31 is already showing a fair response to lime, but in Experiment 32 there are indications only. Experiments 32 and 34 showed very high responses to lime-plus-super combinations. Nitrogen effect was best on ground treated with lime plus super.

Claremont-Fairview-Salisbury District.—Lime alone was outstanding in Experiment 35. Lime plus super was superior to lime or super alone in all cases. Indications of a potash response were shown on limed ground in Experiment 35

Pareora District.—Experiments 39 and 40 were laid down in 1929. The indications to date are that lime is a very important factor. Experiment 38 has been abandoned owing to the pasture running out.

Otaio District.—In Experiment 41 the grass was badly attacked by grass-grub, from which it failed to recover. On two of the experiments super gave good results, more particularly on limed ground. Potash failed to show any effect.

Makikihi-Hunter-Hook District.—Experiments 45, 46, 47, and 48 were laid down in 1929. It is therefore difficult to draw definite conclusions regarding the lime responses, although responses are definite in Experiments 45 and 48. In Experiment 49 the potash response was doubtful. The nitrogen invariably affected the growth of grasses.

Waihao-Forks District.—Lime plus super proved superior to super or lime in both experiments. Potash shows some indication of being effective in Experiment 50.

Waimate-Glenavy District.—The combination of lime plus super again proved effective, particularly in Experiment 54. The effect of potash was indefinite in Experiment 53.

Summary of Experiments between Rangitata and Waitaki Rivers.

Lime.—In fourteen experiments the response to lime alone was good to very good; in thirty-two a slight to fair response is recorded, and in seven others, which have been down about a year at the time of writing this report, there are good indications of a response. Only one experiment is recorded in which lime shows no indication of a response.

Superphosphate.—Response to super alone was good to very good in twenty trials, and slight to fair in twenty-five, in five no response could be detected, while three were indefinite.

Lime plus Superphosphate.—Forty-six of the fifty-four trials showed a decided superiority of lime plus super over super or lime alone. There is no doubt that the use of lime plus super is justified on the majority of good swards of young grass in South Canterbury. The effect of lime and super was almost always accompanied by an increase in clover-growth and a much closer grazing of the sward on these treatments.

Potash.—Only one case is recorded where potash gave good results; in three experiments the responses were slight to fair, and in eight there were indications of benefit. The effect in the latter cases was so slight as to be open to doubt.

Nitrogen.—No case is recorded where nitrogen failed to affect the growth of grass on limed and phosphated plots, especially in the spring, and in some cases the application in the autumn had an effect on the earliness of spring grass. Most of the pastures were too poor to justify the use of nitrogen.

AGRICULTURAL LEGISLATION OF 1930.

A. E. MORRISON, Head Office, Department of Agriculture, Wellington.

LEGISLATION enacted during the New Zealand parliamentary session of 1930 directly coming within the scope of the Department of Agriculture consisted of the Stock Amendment Act, the Slaughtering and Inspection Amendment Act, and the Canterbury Agricultural College Act. The following notes set out the position briefly with respect to each Act :—

STOCK AMENDMENT ACT, 1930.

With the object of compelling the disclosure of all movements of stock by night, and with a view to meeting as far as possible present-day conditions in regard to the transit of stock, this Act extends the scope of the general provision of the present law, whereby a permit is required in respect of the droving of stock by night along any highway, to include the conveyance of stock by night in any conveyance on any highway, or on any lake, river, harbour, or any waters within the territorial limits of New Zealand.

The former exemptions from the general provision that a permit is required in respect of the movement of stock by night are continued under the Act, together with two consequential exemptions to meet cases of stock being conveyed by night by the ordinary rail and steamer services.

SLAUGHTERING AND INSPECTION AMENDMENT ACT, 1930.

This measure adjusts the anomalous position of the law existing prior to its enactment whereby no fees were payable to abattoir authorities in respect of the sale within abattoir districts of carcasses of pigs or of other stock slaughtered and converted into bacon, hams, or tinned meats in specially exempted slaughterhouses whose principal business is the tinning of meat or the curing of bacon and hams, while such fees were payable in respect of the sale of similar meat similarly treated from stock slaughtered in meat-export slaughterhouses. Accordingly the Act provides that fees are no longer payable to abattoir authorities in respect of the sale of such meat in abattoir districts, whether the meat is derived from stock slaughtered in meat-export slaughterhouses or from stock slaughtered in slaughterhouses specially exempted for the purpose.

The Act also makes it clear that no fees are payable to abattoir authorities in respect of the sale within abattoir districts of meat from stock slaughtered in meat-export slaughterhouses and intended for export beyond New Zealand.

CANTERBURY AGRICULTURAL COLLEGE ACT, 1930.

The existing legal sanction for the Canterbury Agricultural College (generally known as Lincoln College), together with that for the Canterbury University College, is contained in the Canterbury College and Canterbury Agricultural College Act, 1896, and in the amendments thereto.

In view of the fact that the Act of 1896 has been amended no less than eight times, and of the further fact that for some time past it has not been convenient that the two institutions should be covered by the same legislation, the law in so far as the Agricultural College is concerned was enacted during the recent session under a separate measure intituled the Canterbury Agricultural College Act, 1930.

Speaking generally, this Act, which comes into force on 1st January next, may be described as a consolidating measure. The opportunity has been taken, however, to bring the law relating to the college into line with certain provisions of the Massey Agricultural College Act, 1926, and of the law relating to the four constituent colleges of the University of New Zealand.

BOYS AND GIRLS' AGRICULTURAL CLUBS.

RECORD OF ACTIVITIES IN 1929-30 SEASON.

1. Taranaki and Wellington Areas.

J. M. SMITH, Instructor in Agriculture, New Plymouth.

ANOTHER successful season's work in connection with the boys and girls' agricultural club movement in the Wellington-Taranaki area must be placed on record. Despite a falling-away in entries in certain section (which can be easily accounted for), the interest in the work is maintained, and the value and importance of the movement thoroughly appreciated by the farming community. The executives in the various districts concerned now have a strong representation of successful farmers on them.

The only new district where the work was introduced during the past year was Ohura, but in the other districts quite a number of new schools came into the scheme. In the area under review there are now some 223 schools competing, with a total of over 1,500 competitors. The main districts and the number of schools competing are as follows: North Taranaki, 48, South Taranaki, 48; Feilding, 44; Wairarapa, 29; Main Trunk Line, 25, Wanganui-Marton, 20; Ohura, 9.

Competitions were conducted on lines similar to those of previous seasons—namely, calf-rearing in both North and South Taranaki and in the Waverley and Ohura districts, and crop-growing in all districts. In the Ohura district a lamb-rearing competition was conducted, with thirteen entries, the winner being Frank Ryan, of Turoto.

CALF-REARING.

The number of calves judged in Taranaki during the past four seasons is as follows:—

	1926.	1927.	1928.	1929.
North Taranaki ..	117	154	215	291
South Taranaki ..	283	344	311	360

This competition is a very popular one, and during the present season calf-rearing is being introduced into several of the districts that have hitherto confined their activities to crop-growing.

Some little misunderstanding still exists as to the method of judging the calves in Taranaki, and no doubt this system will be criticized in new districts, unless an explanation is given The aim and object is to encourage the competitor to take an interest in live-stock, to develop a love for the animal, and to afford instruction as to the most economical way to rear a good calf It is recognized that a calf (or any other young animal) if neglected in its infancy will continue to show signs of that neglect throughout the course of its life; and, conversely, that an animal well looked after and handled as a youngster will grow into an animal which will be a source of profit and a pride to its owner. This being so, it will be seen that the actual rearing and handling are probably the two main features of the competition, and the main points awarded are in this connection. Our term "condition" for this is perhaps not the best, as to some it may indicate a beefy animal, which is not altogether desirable when dealing with dairy stock. But the condition actually is dairying condition, and indicates a well-grown healthy calf showing signs of care and attention, and an animal that should make a good milking cow. A competition of secondary consideration so far as the Club movement is concerned is that for "dairy type." The influence of the competitor has very little bearing on type, so that, while recognizing the importance of this feature, type is not unduly stressed so far as the competitor is concerned.

Judging was again carried out by local farmers who are conversant with the ideas of the movement, and they lost no opportunity of giving good sound instruction to the competitors.

New classes were introduced in North Taranaki for pedigree Jersey, Ayrshire, Friesian, and Shorthorn heifer calves. These in no way compete with the grade animals, the competitions being quite separate. The breed societies have been most obliging and helpful in connection with the pedigree classes. The reason for the introduction of these classes was to cater for those children whose parents were pedigree breeders, and to remove the temptation to "ring in" a pedigree calf in the grade classes. The number of pedigree herds in Taranaki also warranted the inclusion of these classes, and the number of entries received justified this move.

A number of competitors of previous years paraded their animals, which are now two-year-olds, &c., before the judges, and it was most encouraging to those connected with the movement to see how this stock compared with the average animal in the various districts.

The championship judging in both North and South Taranaki, when all the group winners are brought to one centre for final judging, forms one of the most valuable occasions in connection with the competition. In addition to the judging, short addresses on various subjects connected with dairying are given by various experts to the competitors, parents, and others, who gather in large numbers. This field-day forms a fitting climax to the season's calf-rearing competition.

Championship winners in each class and competition are given in Table 1 following.

Table 1.

Class.	Competition.	Winner.
		North Taranaki
Jersey-Ayrshire ..	Condition	Jack Stockman, Oaonui.
,, ..	Type .	Connie Stapleton, Egmont Village.
Shorthorn-Friesian ..	Condition	Connie Stapleton, Egmont Village.
,, .	Type ..	Connie Stapleton, Egmont Village.
Pedigree Jersey ..	Condition	Roy Bell, Oakura.
,, .	Type ..	Roy Bell, Oakura.
Pedigree Ayrshire ..	Condition	May Weir, Mangorei.
,, ..	Type ..	May Weir, Mangorei.
Pedigree Friesian ..	Condition	Maida Soffe, Tikorangi
,, ..	Type ..	Maida Soffe, Tikorangi.
		South Taranaki
Jersey-Ayrshire ..	Condition	Audrey Morris, Bird Road Jean McAsey, Te Roi.
,, ..	Type ..	Helen Nicholls, Otakeho.
Shorthorn-Friesian .	Condition	Gladys Taylor, Fraser Road.
,, ..	Type ..	Brian Morris, Bird Road.
		Ohura.
Jersey-Ayrshire ..	Condition	Pearl Dougherty, Turoto.
,,	Type ..	Pearl Dougherty, Turoto.
Shorthorn-Friesian ..	Condition	Mavis Ryan, Turoto
,, ...	Type ..	Maurice Kelly, Nihoniho.

CROP-GROWING.

This form of competition is now showing a decline in entries, chiefly on account of the change in the methods of farming in certain districts. With ensilage gaining yearly in popularity, and having regard to diseases and weeds experienced in cropping, together with the expense of the latter, less area is being sown in crop each year. This means that ground is not available to a large number of competitors who would otherwise compete.

The completed entries and the crops grown in the different districts were as follows :—

North Taranaki : Mangels, 91 ; swedes, 37 ; Senior mangels, 3– total, 131
South Taranaki : Mangels, 55 , carrots, 52 ; Senior mangels, 4 ; Senior carrots, 7—total, 118.
Wanganui–Marton : Mangels, 74 ; carrots, 47—total, 121.
Main Trunk Railway : Mangels, 73 ; carrots, 24 ; swedes, 3—total, 100.
Feilding : Mangels, 161 : maize, 18—total, 179
Wairarapa . Mangels, 76—total, 76.
Ohura : Swedes, 17—total, 17.

This represents a grand total of 742, compared with 847 in 1928–29.

The season proved somewhat unfavourable, for the continual cold and wet weather throughout October and November adversely affected the germination of the crops, and the warm damp weather during the autumn was the cause of much fungus trouble and disease generally.

The number of crops dropping out before completion of the competition continues to be a cause for regret, and although, generally

speaking, a larger proportion of plots were presented for judging than usual, there is yet room for ample improvement. One pleasing feature is that more care is being taken to see that the areas are made stock-proof, and this generally betokens that more interest is being taken by the parents.

In certain districts some experimental work has been introduced with much success. This adds interest as far as the competitors are concerned, and attracts the attention of farmers throughout the district. For the introduction of new varieties, &c., there is no finer method than through the boys and girls' clubs, as by this means they are grown over an extensive area of country and are seen by a large number of farmers. The same thing applies to any experimental work that can be carried out on such small plots ; a wide range of soil and climatic conditions are covered, and the multiplicity of plots minimizes any error, while the interest of the parents is commanded.

In North Taranaki two varieties of mangels were grown—Prizewinner Yellow Globe and Jersey Queen. The former variety averaged a yield of 56 tons 9 cwt. per acre, and the latter 46 tons 10 cwt. With swedes a trial was arranged in connection with the control of dry-rot. Half the seed was treated with a 5-per-cent. solution of Semesan, while the balance was untreated. The technique was hardly correct, and this mitigated against the success of the experiment so far as disease-resistance was concerned. The weights, however, were 35 tons 13 cwt. per acre for treated seed and 32 tons for untreated.

This same trial with swedes was carried out in Ohura, where the yields were 34 tons for treated and 33 tons 3 cwt. for untreated. At Nihoniho, where the two plots were kept 4 ft apart, and where the implements were always used in the treated plot first to prevent the disease being carried to it, the treated plot was not affected with dry rot, while the untreated had at least 60 per cent. of the swedes affected with the disease.

In South Taranaki the same two varieties of mangels were grown (Prizewinner Yellow Globe and Jersey Queen), and these weighed out at 62 tons 19 cwt. and 55 tons 6 cwt. respectively. With carrots, Improved Red Intermediate and Matchless White were grown, the Reds weighing out at 32 tons 17 cwt. and the Whites at 40 tons 11 cwt.

The maize grown in the Manawatu district originated from varieties imported from the United States as characterized by relatively quick maturity. The crops obtained were somewhat disappointing and distinctly variable. Of the varieties grown, Minnesota No. 13 gave definitely the best results, and would seem to be the only one worth while giving attention to under the conditions obtaining last season.

CHAMPIONSHIP RESULTS.

The results for the championship and the average yields were as follows :—

North Taranaki :—

	Tons	cwt.
Mangels :		
1st, Val Penwarden, Tataraimaka	127	2
2nd, Jim Heppell, Huirangi	108	17
3rd, Doreen Baker, Pukearuhe	90	15
District average	51	0

	Tons	cwt.
North Taranaki—continued.		
Swedes		
1st, Cyril Watson, Hurangi	56	11
2nd, Leon Goppath, Kaimero	62	0
3rd, Alf O'Byrne, Egmont Village	31	13
District average	33	12
South Taranaki :—		
Mangels :		
1st, Les Muggeridge, Auroa	128	17
2nd, George Loving, Huinga	109	8
3rd, Jack Hackett, Okaiawa	100	15
District average	59	3
Carrots :		
1st, George Loving, Huinga	61	14
2nd, Louis Muggeridge, Auroa	61	7½
3rd, Marjory Larcom, Ararata	53	16
District average	35	6
Wanganui-Marton :—		
Mangels :		
1st, Ward Ell, Waverley	105	2
2nd, Des Fitness, Waitotara	113	0
3rd, A. Middleton, Waverley	123	8
District average	58	4
Carrots :		
1st, Francis Huwyler, Kai Iwi	68	9
2nd, Glaves White, Maxwell	66	4
3rd, Ward Ell, Waverley	50	15
District average	32	9
Main Trunk Line :—		
Mangels :		
1st, P. Weston, Mangaonoho	104	9
2nd, N. Paget, Mangaonoho	94	16
3rd, A. Illston, Silverhope	93	10
District average	51	0
Carrots :		
1st, P. Weston, Mangaonoho	65	17
2nd, L. Rowe, Mangaonoho	64	5
3rd, G. Sands, Orautoha	45	12
District average	30	0
Swedes :		
1st, D. Bougen, Ngamatea	65	5
2nd, K. Chittock, Ngamatea	58	16
3rd, P. Kennedy, Ngamatea	16	8
District average	40	16
Feilding :—		
Mangels :		
1st, R. Hill, Rongotea	120	1
2nd, A. Christensen, Oroua Downs	113	9
3rd, M. Christensen, Oroua Downs	105	2
District average	50	6
Maize :	Bushels.	
1st, M. Christensen, Oroua Downs	97½	
2nd, A. Christensen, Oroua Downs	82½	
3rd, R. Davis, Glen Oroua	66½	
District average	40	
Wairarapa :—		
Mangels :	Tons	cwt.
1st, Jean McGovern, Mauriceville	99	13
2nd, Walter Allen, Kohinui	85	3
3rd, Alexa Polglase, Ballance	82	5
District average	37	14
Ohura :—		
Swedes :		
1st, Ruth Shields, Rauateti	62	10
2nd, Jack Dougherty, Turoto	50	12
3rd, Doug. Mossman, Waikaka	41	16
District average	34	0

TROPHIES AND SPECIAL PRIZES.

The Henry Lane and Co. Challenge Shield for the school doing the best club work was awarded to the Ararata School, South Taranaki; for the second successive season. The total number of points gained by this school was 64.

In North Taranaki the trophy for the best-kept plot was won by Jim Heppell, Huirangi. In South Taranaki this trophy was divided between Jester Bootten, Rawhitiroa, and Basil Piper, Finnerty Road.

In the Wanganui district the Thomas Cup, awarded to the school gaining most points in show classes, was won by Westmere School, with a total of 22 points out of 24. The Farmers' Union Shield was won by Upper Tutaenui, with 36·5 points out of 40.

The following competitors in the Feilding District were awarded special prizes for securing the possible points in cultivation: B. Dungey (Aratika), M. Wealleans (Aratika), L. Murray (Ohakea), C. Vautier (Whakaronga).

SENIOR CLUBS.

The season under review is the fourth in which the senior clubs have been in operation in Taranaki. It was hoped that means would be found whereby better touch could be maintained with those junior competitors who, after going through their secondary education, were returning to the land, but the success achieved was not great. During the present season an endeavour is being made to arouse interest in this connection through the Farmers' Unions.

In North Taranaki the crop chosen was mangels, but only four entries were received. The placings were as follows:—

	Tons	cwt.
1st, Dick Oliver, Lepperton	78	8
2nd, Eugene O'Callaghan, Lincoln Road	33	17
3rd, Pat O'Callaghan, Lincoln Road	29	16

The crops grown in South Taranaki in connection with the Senior clubs were carrots and mangels, for which there were seven and four entries respectively. The carrot crops averaged 47 tons and the mangels 63 tons 2 cwt. The detailed results were as follow:—

	Tons	cwt
Mangels:		
1st, Lloyd Walker, Otakeho	68	13
2nd, Jack Walker, Otakeho	67	12
Carrots:		
1st, Sid. Cleaver, Matapu	60	2
2nd, Allan Wetton, Matapu	60	12
3rd, Harry Feather, Manaia	54	6

(To be continued.)

South American Wools.—Cabled advice received from the International Institute of Agriculture, Rome, states this year's wool-clip in Argentina amounts to 342,000,000 lb., and the Uruguay clip to 154,000,000 lb.

Noxious Weeds Orders.—Kiwitea County has declared the following plants to be noxious weeds under the Act: Barberry, Bathurst burr, broom, burdock, goat's rue, gorse, lantana, St. John's wort, and tutsan. The county has also declared Californian thistle *not* to be a noxious weed within its territory. Waimate County has declared hemlock; Christchurch City, convolvulus; and Lower Hutt Borough, broom, fennel, gorse, and hemlock.

SEASONAL NOTES.

THE FARM.

Pasture Management.

FREQUENTLY towards the end of November or during the early part of December the excessive amount of herbage on the fields under grazing constitute definite evidence that the growth has been more than sufficient to meet the requirements of the stock When this condition becomes noticeable extensive loss of control of growth is imminent, and unless suitable means of bringing about proper control are adopted poor quality will soon develop in the herbage, and there will be a falling-off in the production of fresh growth in the autumn.

When at this stage the fields under grazing are producing in excess of the requirements of the stock it is often advisable to drop from the grazing programme a field or fields in addition to those which have already been closed for hay or ensilage Even when an additional field is closed up at such a late stage it may produce a light cutting for hay or ensilage, but even if the growth on it cannot suitably be so used, and hence has to be more or less wasted, this is preferable to the general poor control of the pastures which would have resulted from keeping the field in the grazing programme. The essence of good pasture-management during midsummer is to have some at least of the paddocks producing short, fresh, highly digestible growth—it is much better to have some fields well controlled and some really badly controlled than to have all really badly controlled. The latter condition is the result often obtained by trying to graze an area giving growth in excess of the current requirements of the stock.

At times, and particularly when a farm is somewhat poorly subdivided, it may be impossible to drop a paddock from the grazing programme without reducing too greatly the area being stocked. Under such circumstances topping of the pastures with the mower when portions tend towards rank growth and flower-head production is a measure which gives good results. Topping in this manner is not recommended as a general practice; it is to be considered rather as an emergency measure which may be adopted with advantage when the utilization of pastures has not turned out according to expectations As a means of dealing with surplus summer growth it is an alternative or second choice to ensilage or haymaking, but it is definitely a second choice. The ideal method is to conserve all surplus summer growth as hay or silage for use during periods of shortage. Often topping is done at a later stage than is desirable; an endeavour should be made to top the pasture early enough to allow of the development of a fresh growth to provide valuable feed from Christmas onwards. Topping has at times been objected to on the grounds that it would leave the pasture so short as to result in undue drying-out during the dry period that often occurs in late summer. This objection is really not to the point, because the mower can be set to give a comparatively high cut and thereby any danger of drying-out avoided, even if dry weather were to set in immediately after the topping—a happening which is quite unlikely unless the operation is carried out unusually late. Circumstances which specially tend to make topping advisable occur firstly when there are few or no dry stock to follow wet stock to remove rough growth left by the latter, and again when harrowing of pastures has been previously neglected. Often during late November or early December it is advantageous to harrow pastures which have been heavily stocked earlier in the season.

Frequently some of the grassland may with advantage be dressed with superphosphate in the early summer. Such a dressing not only will stimulate the production of fresh growth during the latter part of the season, but also will make its influence felt during the following season. If other pastures not top-dressed in the summer are top-dressed in the autumn, the two lots of top-dressing will materially ease the problem of winter feeding. Summer top-dressing as suggested is most effective in parts where a good deal of rain may be expected during December and January, and it declines in effectiveness as the December-January rainfall decreases.

Grassland from which hay or ensilage has been saved usually responds profitably to a December dressing of superphosphate, which favours a vigorous aftermath yielding fresh feed at a period when it is apt to be in scant supply.

Haymaking.

Primarily because of the prevalence of unfavourable weather at the proper haymaking period, much of the hay saved each year is of inferior quality, due either to waiting till favourable weather is experienced and thereby allowing the herbage to become far too mature and woody, or to mowing at the proper stage and being forced to save the hay under unfavourable conditions. In these facts lies part of the strong case for ensilage over wide areas Late mowing is objectionable not merely because it makes the production of inferior stemmy hay a certainty, but also because it brings about greater weakening and opening-up of the sward, and militates against a really satisfactory aftermath which may prove valuable as a source of succulent highly nutritious feed during the latter part of the summer.

As so many advantages attach to the cutting of the hay crop at the proper stage of growth it behoves one to consider carefully all measures which will enable this to be done and at the same time the herbage to be saved in good condition. Cocking of the hay is one of the measures which should be considered more than it seems to be. Over much of the Dominion it is doubtful if a heavy crop of hay can be well saved without cocking, and with average crops, after making due allowance for the extra labour that cocking at times involves, it could with advantage be adopted on occasions when it is not practised. Cocking is to be looked upon as the ideal method of obtaining the best possible quality hay when the weather is not altogether reliable, and although ideal methods are not always the best from the economic aspect they generally should not be departed from without sufficient reason. Cocking proves particularly valuable in the saving of good-quality lucerne and clover hay.

In the building of the stack a good deal can be done towards securing good quality in the hay. The site should be well drained, and it should not be unduly shaded in a way which will remove the drying influence of winds. For the stack bottom there should be an ample supply of material, such as posts or rails or tree branches, which will favour a dry base of the stack. A high stack should be built so that the roof will be small in proportion to the amount of hay. Although a square stack enables a greater bulk to be stored for a given amount of surface, yet long narrow stacks are often to be preferred, because they admit of more ready drying and cooling of the stacked material. No one working on the stack should stand long on one place, as this causes uneven settling.

If broken weather occurs just after an area has been mown the herbage should within reason not be disturbed until good weather has returned. Any handling that mown material receives makes it much more subject to the detrimental influences of bad weather. If bad weather seems likely the cocking should be hastened, for the amount of washing-out of nutritive matter by rain is much greater when the herbage is in the

swathe than when it is in cocks. In cocks the herbage may cover only one-fifth of the ground it occupies in the swathe; hence it will be subject to the washing-out influence of only one-fifth the amount of water

The best time to cut lucerne cannot always safely be determined by the flowering development. A safer guide is the development of basal shoots. When fresh shoots coming from the base or crowns of the plants are about an inch long the lucerne should be mown.

General Cropping Work.

After allowing fully for what can be done in the sphere of good grassland-management one is forced to the conclusion that the growing of special crops for stock-feeding could often with advantage be made to occupy a much more prominent place than it is now given

The great importance of the special crops used in our system of animal husbandry arises primarily from the fact that most of these crops serve the function not of coarse fodders or roughages, but of concentrates. Concentrates essentially are low in fibre and highly digestible. The need for them arises specially when the remainder of the ration of which they form a part consists of woody fibre of poor digestibility, and the need for plenty of concentrates becomes specially pressing in the nutrition of animals of high production Crops such as green lucerne and green cereals before they are in bloom, turnips, and rape are essentially concentrates. They are diluted concentrates it is true, but nevertheless concentrates by virtue of their composition and of the functions they can fulfil. To a considerable extent they take the place in our farming that concentrates out of a sack take in European and American farming in supplementing the coarse fodders or roughages

All this may seem a somewhat irrelevant digression if it is not kept in mind that the relatively expensive grains and meals freely used in other countries may be replaced in New Zealand to a great extent by the comparatively inexpensive farm-grown "diluted concentrates" provided by such crops as soft turnips, rape, &c. In reality our markedly economical butterfat and fat-lamb production hinges on our cheap concentrate-feed production through the agency of young grass and suitable forage and root crops. This will indicate the importance of factors which limit the yields of such crops Inadequate cultivation is such a factor. Farmers' crop competitions have been of considerable instructional value in demonstrating in a concrete manner that money spent on good land, good manure, and good seed is at least partially wasted if not linked with good cultivation. The cultivation which precedes seed-sowing is of basic importance; if it is deficient nothing can be done later to remedy the position fully.

Thorough preparatory cultivation, however, while valuable, is far from sufficient. Intertillage, when practicable, should be carried out as soon as possible after seed-sowing with such crops as mangels, potatoes, and carrots. All these and similar crops thrive on ample working of the soil round the plants, because such working not only kills weeds but also conserves the supply of soil-moisture and otherwise increases the soil fertility.

Apart from intertillage, root crops which were sown on ridges during October or November usually require thinning in December. In thinning mangels the soil should be drawn away from the seedlings rather than hoed up to them. The space between mangels may range from 9 in. to 15 in. according to the conditions; on the average it should be about 12 in., but Yellow Globes on really good soil may be spaced 15 in. apart.

If at thinning-time mangels are pale and seem to be faring poorly, they will often respond profitably to a top-dressing of nitrate of soda or

sulphate of ammonia sprinkled along the rows, at the rate of 1 cwt. an acre, in such a manner that the fertilizer is not deposited on the seedlings. These manures should if possible be applied during moist weather.

Based upon experience it has become the practice over wide areas to sow swedes in December at the rate of 10 oz. to 14 oz. per acre through every second coulter of an ordinary grain-drill. Information regarding turnip manuring in Canterbury is given in a separate article in this issue of the *Journal*. If it does not suit to use lime in the manner suggested in the article, a mixture of super and one of the slower-acting phosphates in equal proportions may be used. The slower-acting phosphates include basic slag and the Island and African phosphates. In many parts with a reasonable rainfall a mixture of superphosphate and bone-dust gives excellent results with swedes. A fine firm seed-bed favours a good strike with swedes.

Maize and millet to provide green fodder may often be sown successfully in December.

Much valuable weed-control work can be done in midsummer, either by destroying seedlings or by attacking perennial weeds when they are in the early flowering stage well before seeds have advanced towards maturity

Spraying for Control of Potato-blight and Similar Diseases.

As a rule satisfactory results are obtained only when spraying is treated as a preventive rather than as a cure. Spraying is of distinct value in checking the spread of blight which has gained a footing in a potato crop, but its greatest value lies in preventing the footing being gained. This means that spraying should be commenced early, before the disease has become established. The following note by Dr. G. H. Cunningham, Mycologist to the Plant Research Station, is of seasonable value, especially because it contains a description of a modified improved method of preparing bordeaux mixture for potato-spraying. Dr. Cunningham says :—

"Of the sprays available, burgundy and bordeaux mixtures are generally used, lime-sulphur or sulphur alone having proved of little use.

"Burgundy mixture: This spray, made by mixing bluestone (copper sulphate) and washing soda (sodium carbonate), has long been a favourite owing to its ease of preparation. The formula recommended is 4–5–40 (4 lb. bluestone, 5 lb. soda, and 40 gallons water). To prepare, nearly fill a 40-gallon cask with water, and to this add the bluestone (dissolved in a small quantity of hot water) ; dissolve the soda in a small quantity of water, and add to the cask, stirring vigorously the while. Bring the quantity of water up to 40 gallons, and apply as rapidly as possible.

"Bordeaux mixture : This consists of a mixture of freshly slaked quicklime and bluestone. It has largely become replaced by burgundy owing to the difficulty of securing a proper mix and of procuring and storing the quicklime. This is to be regretted as it is a more efficaceous spray, and for this reason the following modified method of preparation is recommended, together with a formula of 3–5–40. Dissolve the bluestone and add to the water in the cask ; then weigh out the required quantity of *hydrated* lime, cream it by mixing the powder with a small quantity of water until it assumes a cream-like consistency, and pour into the solution of bluestone in the cask. Prepared in this manner this solution is just as easy to make as burgundy, and considerably more effective.

"To prepare hydrated lime weigh out a given quantity of good-quality quicklime, and add to it one-third of its weight of water. Thus 30 lb. of quicklime will require 10 lb. (1 gallon) of water. The result will be an impalpable fine white powder mixed with impurities present, such as sand, fragments of rock, &c. Sieve through a fine mesh, screen, and store in air-tight containers, where it may be kept indefinitely until required. This quantity of water ensures that slaking will be complete and that the

resultant will be in powdered form. Hydrated lime changes slowly back to the carbonate on exposure to the air. The change is slow, however, so that little conversion occurs until some weeks after its preparation, and for this reason small quantities can be held in open benzine tins during the spraying season.

"The advantages of this bordeaux spray over burgundy are: (1) The spray is more insoluble, and therefore lasts much longer on the plants; (2) being more insoluble it is less likely to damage foliage; (3) it is a better fungicide; (4) it can be mixed with arsenate of lead (as a controllant of chewing insects), whereas burgundy cannot."

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Spray Controls.

THE treatment of the orchard during the coming month must be regarded as of vital importance Humidities and temperatures are conducive to fungus development, while the initial and in most cases the main broods of insects will be increasing unless vigorous and well-timed attention is given to controls. Close and careful observation of detail in both fruit and foliage is well-spent time, and it can be recommended to all growers to spend a few hours each week in carefully checking developments of fungus diseases and insect pests on the different varieties. The result of such observation will often adjust and correct for the better an otherwise more-or-less fixed spray programme.

From now on precipitated sulphurs are recommended as supplementary to the weak dilutions of lime-sulphur and arsenate of lead combination. Although in some instances precipitated sulphur alone may be used to advantage on such tender varieties as Cox's Orange and Dunn's Favourite, the greater value lies in the practice of adding 3 lb to 5 lb. to lime-sulphur. By so doing the sulphur content of an otherwise dilute solution is raised to a more efficient standard without materially increasing the caustic properties of the spray. Cases have recently come under the notice of the writer where growers were adding as much as 5 lb. of precipitated sulphur to a spray of 1-25 strength. This appears to be extravagant and needless, the sulphur content of the solution being sufficiently high to give full efficiency.

Thinning, Relief of Leaders, &c.

Towards the end of November thinning can be commenced on early varieties, having in mind that the operation should be regarded as part of a progressive practice. The natural drop of all varieties will hardly have finished by the end of the month, while a progressive thinning will give a longer period in which to discard diseased or otherwise worthless fruit.

The picking-off of fruit which has developed from fruit-buds situated on the terminals of leading branches should now be completed immediately, so that maximum growth may be obtained in this section of the tree Weak fruiting laterals which have obviously set more fruit than is desirable should also be relieved at the initial thinning.

Red Mite Pest.

Those districts which have experienced a dry October may expect bad infestation from red mite. Where such is the case an application of red-oil emulsion at 1–200, plus Black Leaf 40, or the addition of Black Leaf 40 to the routine applications of lime-sulphur, will do good work in preventing serious infestation at the latter part of the season. At this time of the year red mite is often confined to certain varieties or locations in the orchard, and in such cases prompt measures will prevent the pest becoming

general throughout the orchard. There is little doubt that many growers regard red mite too lightly, largely due to the fact that this insect does not render fruit unmarketable. They lose sight of the debilitating and weakening effect of the pest on the trees, which is subsequently reflected in a light crop the succeeding year, diminished wood-growth, and a loss of resistance to chemical spray compounds.

Cultivation.

From the month of November onward a top mulch of pulverized soil should be maintained in order to conserve reserves of moisture, to ensure as uniform a growth as possible, and to enable the proper functioning of artificial fertilizers which may have been applied.

—*M. Davey, Orchard Instructor, Mapua.*

Citrus Culture.

As the spring growth on citrus trees which escaped the winter frosts should now be well started, all undesirable shoots can be rubbed out, thus saving time later on.

As mentioned in last month's notes, a careful watch should be kept for fungus disease. When the main crop of blossom has set lemons should be sprayed with bordeaux 4-4-40 for verrucosis, and owing to the prolonged flowering period it will be necessary to make two or three applications to ensure a clean crop of young fruit. Owing to the weather conditions experienced this spring the liability to brown-rot has increased, and care should be taken to see that all lower branches are at least 18 in clear of the soil. A light dressing of sulphate of iron beneath the trees to destroy the fungus spores in the soil, together with the application of bordeaux as previously specified, should help considerably in keeping away this trouble

Should scale be in evidence, spraying with a summer oil 1-40 is advisable, and where thrips are present the addition of Black Leaf 40 at 1-800 can be made; or, if preferred, the Black Leaf can be combined with the applications of bordeaux. A good look-out for borer should be continued, and treatment given as advised in the previous notes.

As soon as the weather is settled every effort should be made to cultivate the surface soil to a good tilth while it is in an easy workable condition. Not more than 6 in. in depth is desirable, owing to the liability of injuring the feeding roots

Trees which have suffered from the frosts should have all the frosted wood cut back to clean wood, so as to give the new growth every advantage

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Artificial Stimulants to Egg-production.

A SURPRISING number of poultry-keepers have sought my advice of late as to the value of certain chemicals, tonics, condiments, &c., for stimulating egg-production, with the idea of counteracting the present increased cost of production caused by the high prices of foodstuffs. Usually such inquiries come from those who have had little experience in the business, and who fail to realize that a maximum egg-yield can be secured from a simple ration in which condiments and questionable stimulants are not included.

It should be remembered that the power to produce eggs in large numbers is an hereditary character To enable a bird to yield to her maximum capacity all that is required is to maintain her in a healthy condition and to supply her with the necessary food for the making of her

product. It has been said that for the maintenance of good health the heavy layer should be periodically provided with a tonic, but in this connection it is well to remember that the food and treatment which will enable a bird to produce to the best advantage will also be for the benefit of its health and consequent freedom from disease.

The best advice I can give those who are looking to theoretical short-cuts for advancing egg-production, and at the same time looking to questionable stimulants as a means of reducing the cost of production, is to keep only those fowls that will show a profit—by culling and better feeding. Food is certainly high in price, but nothing will be gained by stinting the layer. It is always a sounder policy to feed half a flock thoroughly than put the whole flock on half rations. As to the use of condiments and questionable stimulants for consistently increasing egg-production, this is answered by the fact that the high records put up at laying competitions, both with fowls and ducks, are established without the aid of these materials.

Efficient Feeding.

No definite amount of food can be specified for daily supply to any given number of laying fowls. The only safe course is to feed them according to their appetite. The rule of weight or measure cannot be fixed, because the birds do not eat the same amount of food each day or at each meal. Their appetites vary according to the season of the year and whether they are in a laying condition. Obviously as egg-production increases the bird will demand a greater food-supply, because it is impossible to get something from nothing. There are many different rations that will produce good egg-yields. The great essential is to see that the food is of good quality, palatable to the birds, and fed in sufficient quantities. Not only should sound and palatable grain material be provided, but in addition some form of animal food should be included in the ration. Instinct in the laying bird demands an adequate supply of animal food, and if deprived of this she will not produce to her maximum capacity. When boiled meat is not obtainable a reliable brand of meat-meal makes a good substitute. This material may be supplied in the morning mash at the rate of, say, 8 per cent. of the aggregate weight of the mixture when dry. In addition the meal may be fed in a separate receptacle and left for the birds to pick at whenever they choose.

When skim-milk is available this may take the place of meat and meat substitutes, as there is nothing better for promoting egg-production. Indeed, it is good for stock of all ages, except perhaps in the case of the growing pullet, when, as with any forcing diet, too much milk is apt to promote egg-laying at too early an age before the bird attains proper body development This usually results in a weedy specimen of the breed and a producer of small eggs. Where it is found that a pullet is showing evidence of prematurity the milk should be used sparingly or, better still, eliminated from the ration. Particularly should the birds not be compelled in hot weather to drink a large quantity of milk merely for the purpose of quenching their thirst, or ovarian troubles and the production of weak-shelled and shell-less eggs are apt to result. Where milk is provided in large quantities the risk of these troubles making their appearance will be minimized if water is provided in a separate receptacle. A good method of using skim-milk is to let it sour and coagulate, which may be hastened by the inclusion of a small quantity of pollard. After the whey has been poured off it is a good plan to place the curd in a lightly woven sack and allow it to drain well before feeding to the birds.

Economy in Production.

While recommending sound and liberal feeding, it is fully realized that the profit from poultry-keeping is not so much determined by the gross

return as by the difference between cost of production and the market value of the produce. Probably the chief means whereby the average poultry-keeper could reduce his food-costs, and thereby make a greater profit from his fowls, is to use a larger proportion of feeding materials which can be grown on his own land. This mainly applies to green stuff, as it will seldom pay the average poultry-keeper to grow grain on a scale to suit his requirements. But though it is possible to reduce the cost of feeding on many plants by growing and feeding a greater quantity of green material, even in this direction there is a point beyond which cheapness in feeding may easily become false economy. For example, when the morning mash chiefly consists of boiled laxative green material, such as cabbage, silver-beet, turnips, &c., dried off with a very little pollard (which is often more like bran than the genuine article), it is only to be expected that for the lack of a due proportion of solid matter the birds' egg-laying must be reduced—and no stimulant will help it The value of green food for birds of all ages is great, but in the case of the layers it is always a wise course to provide it in such a way that they can take just what they want without being compelled to eat more than nature demands Hence when high egg-yields are looked for green-stuff should be sparingly used as a means of bulking the morning mash, but fed with a free hand by itself.

Where suitable soil is available the growing of a patch of lucerne is recommended. The feeding value of this highly nitrogenous plant, as compared with others commonly used for feeding purposes, is not generally realized by poultry-keepers as it should be. Lucerne serves a dual purpose, as it can be fed as a green food during the greater part of the year, while any surplus can be easily made into hay for winter use Finely chaffed well-cured lucerne hay, boiled overnight and mixed in the morning mash (in which it can be included to a greater extent than other more laxative foods) not only has the effect of making the mash more appetizing to the birds, but, being rich in protein, also tends to promote egg-production. Hence it replaces to a great extent the more costly grain-foods, thereby effecting a desirable economy. Red clover is another fodder plant that may be grown by the poultry-keeper and fed with advantage in a similar manner to lucerne.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Requeening.

THE most important bee within the hive is the queen, and it is useless to expect a colony to be productive unless she is a good one. It is therefore highly essential that all colonies should be headed with prolific queens of a good strain if vigorous workers are to be raised. Queen-rearing is an important adjunct in apiary-management, and unless provision is made to requeen systematically the beekeeper will find dwindling colonies and diminished crops. Where practicable, it is advisable to requeen the colonies every year. Exception, however, must be made in the case of hives containing breeding-queens, and others retained on account of desirable drones.

Where the operations of the beekeeper are such as to prevent annual requeening, provision should be made to replace half the queens in the apiary each year, If this plan is followed no colony will have queens more than two years old. With the aid of a few nuclei young queens can easily be hatched and mated, but in many cases—especially where a swarm has emerged from a hive—virgin queens can be secured and form an easy solution of the requeening problem.

No better plan can be followed by the beginner than to utilize queen-cells produced naturally—that is, under the swarming impulse. It has been proved that in New Zealand the best months for raising queens are from November to January. During this period everything is favourable to the operation, as the hives are at their highest state of prosperity. Under normal conditions the workers and drones are at their best, this being the swarming period. There is practically no risk of robbing; the young queens are readily accepted, and will tend to reduce swarming. Moreover, a queen introduced during the months of prosperity will produce numbers of young bees for the winter, and still be fairly young in the following spring In the case of after-swarms, these may be sifted through an excluder placed between two empty supers, when the queen or queens can be removed. The bees will then return to the parent hive.

These young queens can be utilized for starting nuclei. It always seems a pity to destroy the young vigorous queens bred under the swarming-influence, and wherever there is an opportunity they should be saved and failing queens destroyed A handy method of introducing virgin queens is by the smoke method. The old queen must first be removed from the hive that is to be requeened. The entrance then is contracted, and a few vigorous puffs of smoke are forced in through it. Then, before the bees have recovered from this treatment, the virgin queen is released at the entrance, piloted into the now queenless hive, and hastened therein by several more puffs of thick smoke The hive is then closed altogether for about ten minutes, after which the entrance is once more opened slightly and left like this till the next day, when the full entrance can once more be allowed.

Extracting Preparations and Practice.

Preparations for extracting the honey must now be well in hand By the time these notes are published the main flow should have started in the North, but it will depend entirely upon weather conditions. In the South the flow is fully three weeks later, and extracting rarely commences before the New Year.

It is well to get all the arrangements for handling the crop completed before the honey is sealed and ready for the extractor. It does not take a great deal of time to prepare extra supers and frames, but these are of inestimable value to the beekeeper when the main flow commences. Every year immense quantities of honey are lost through lack of proper gear for handling the crop, or through the unreadiness of the beekeeper when the hives are full of honey. It is poor economy to keep one's supply so low that the bees hang about outside the hive and loaf for want of combs in which to store the honey.

Room should be provided for the workers as soon as the first honey is capped, either by extracting the combs or by supplying them with another super. Keeping the extractor running from the beginning of the honey-flow till the end is good beekeeping, provided the honey is not extracted while in an unripe condition. Although some authorities advocate leaving all the honey until the end of the season—thereby building colonies three and four stories high—the result is rather heavy work, and this method is anyhow not advisable in Southern localities Where the summer is short and variable the risk of getting the honey chilled by leaving it in the hives until the end of the season is too great Honey, except in a few instances, is best extracted when warm from the hives. In fact, where there is any tendency to "thick" honey, extracting while the honey is warm is the only way to obviate breaking the combs in the extractor.

Comb-honey should be treated in the same way All sections should be removed from the hives as soon as they are filled. This makes them less liable to be daubed with the propolis and to become "travel-stained" by the constant passage of the bees.

The extractor, tank, and all the rest of the gear connected with the handling of honey should be scalded and thoroughly dried before commencing the season's work Honey, by reason of its peculiar method of production, does not call for the daily cleansing required by other foods, but it behoves the beekeeper to see that his honey-house is as trim as hands can make it After the extractor has been scalded it should be kept covered with a clean washing cover when not in actual use, and every receptacle containing honey should receive the same treatment These covers are easily made and washed, are inexpensive, and add much to the condition of honey as an article of food No bees, flies, or any extraneous matter should be allowed to touch the honey once it leaves the extractor, and from the time the bees gather it till it leaves the beekeeper's hands for market his aim should be to produce a dainty and attractive article of food

Extracting-appliances.

It is useless trying to work bees profitably without proper appliances. These consist of an extractor, uncapping-knives, uncapping-can, and settling-tanks. Many beekeepers make the mistake of trying to get along with any makeshifts, but experience will teach that it is a poor policy to endeavour to operate without an up-to-date equipment However small the number of hives kept, if extracting is the objective it will be found to be most profitable to install a four-frame machine Costing a little more at the initial outlay, it will soon pay for itself in labour-saving, and enable the beekeeper to meet the biggest flow. In any case he should not be persuaded to purchase a machine that will not reverse. Fixed machines are labour-makers, besides being messy in working When fifty or more colonies are worked it will be found that a power plant pays for itself over and over again.

Second in importance is a good tank. No apiary equipment is complete without one or two good tanks. Too little attention is paid to maturing the honey when out of the hive, and freeing it from the minute particles of wax which float on its surface. It must be left to the beekeeper to decide the size of tank he requires, this depending on his needs and conveniences.

For rapid working, two ordinary uncapping-knives are very convenient, but as yet no better invention has been given to the beekeeping world than the steam-heated knife. This knife obviates the necessity of constantly dipping the cold knives into hot water, and the work of uncapping can proceed uninterruptedly. There are several uncapping-cans and melters on the market, most of which are more or less satisfactory, but the perfect capping-melter has yet to be invented.

Treatment of Disease.

If the weather conditions have not been favourable for the treatment of foul-brood, this should be undertaken when the first opportunity occurs. Do not delay until the main flow arrives. Remember that if colonies are treated early enough a surplus of honey will be secured and the expense of treatment recovered. Handling clean bees is a constant source of delight, but diseased bees are a never-ending cause of trouble. Full particulars of the treatment of foul-brood are given in Bulletin No. 110, "American Foul-brood and its Treatment," which can be obtained free from the Department of Agriculture, Wellington, or from the Apiary Instructors in each centre.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Tomatoes under Glass.

THE production of tomatoes under glass has now grown into a big industry, and in Southern districts many of the houses are heated. When artificial climatic conditions are created for growing the crop it is necessary to see they are properly maintained. The need is still greater when heat is used and the object in view is to ripen the crop at a still earlier period. The houses then require a great deal of attention. In this phase of tomato-culture there is often room for great improvement. To go to the expense of this equipment and then find one has not time to attend to it is serious mismanagement, but the excuse is bad, as it would pay to obtain further assistance if the management was right. During late winter and early spring the weather and temperatures are notoriously variable, and frequent adjustments are needed to maintain the right temperature and humidity in a crop under glass Obviously this is best done by one who takes or is given the direct responsibility of attending to the houses, and who is constantly at hand to do so. In this way only can the right conditions be maintained, and the crop then develops in a satisfactory manner within the expected period. The successful crop is one which has been grown under good conditions right from the sowing of the seed ; every vicissitude takes its toll by diminishing or deferring the harvest

The installation of the "Iron Fireman," which automatically stokes the furnaces, in the larger greenhouse plants indicates the enterprise of growers and extent to which the industry has developed. The machine has given great satisfaction ; it can be finely adjusted, and temperatures are controlled automatically by the operations of a thermostat. In one or two instances, however, the necessity for ventilation, which still remains, has been overlooked. The tomato-plant by nature requires a comparatively dry, buoyant atmosphere, and it is only by means of ventilation that this can be obtained. A close, humid atmosphere produces soft thin leaves, and the flowers fall without setting. The plants also are very subject to disease under such adverse conditions.

The earliest crops are grown in pots in a heated house. This method has been demonstrated to induce earlier maturity than when the plants are set out in the ground. The advantage is offset by the extra attention required in the way of watering and feeding, but under some circumstances it is satisfactory. In this method of production trouble is sometimes met with by cold water being used for watering the plants. Such treatment causes a serious check in the growth and development, and is really inexcusable. The boiler-capacity is generally sufficient to provide the quantity of tepid water required, and which should always be used in heated houses.

Small Fruits.

The harvest season for small fruits has now arrived, and growers are busy packing and consigning the fruit. The prices and demand are generally good, but the perishable nature of the berries makes the work difficult, especially when production is large in restricted areas. The distributing campaign then requires to be well worked out, and the rules for picking and packing carefully observed. Some organization is required to give this a full measure of success, but it would be a fine achievement and a great benefit to many sections of the community.

Berries growing on land that is naturally overdrained frequently suffer at this season if the weather is dry, especially strawberries and raspberries. Under such circumstances irrigation would be of great benefit in developing the crop. In strawberry-beds the runners should be destroyed, unless they are required for planting later, in which case the plants should not be

allowed to bear fruit. Suckers and basal growth about gooseberries and red and white currants should be removed; also crowded water-shoots about the centres of gooseberry plants.

Market Garden Crops.

During the months of December and January the following crops, which mature during the winter and early spring, should be planted: Savoy cabbage, brussels sprouts, broccoli, cauliflower, celery, and leeks Make sure that the plants are free from disease before shifting them Water them the day before lifting, and then ease them with a fork so that the roots are injured as little as possible Plant rather deeply and firmly in dull weather. Keep a watch for pests or disease, and give them a puff of dust or spray as may be necessary. The celery is almost sure to require a burgundy-mixture spray occasionally to protect the plants from fungus blights.

As the early crops are lifted sow shorthorn carrots, turnip-rooted beet, spinach, peas, dwarf beans, swedes, and lettuce. The latter is best sown thinly at this season, with a view to it maturing without transplanting.

The Homestead Garden.

There appear to be two methods of pruning established hydrangeas generally practised in this country. The one is to cut all the young growth back very hard and the other to thin it out severely, removing especially the weak and old wood. The latter is much to be preferred; the plants flower better and earlier Under the former method the growth is very dense, and flowers are meagre and late in appearing.

These notes are written during "lilac time," and the generous display of lavender, white, and purple spikes of blossom is very attractive. It is to be noted the blooms are best where the bushes are well thinned out and all suckers suppressed The thinning is best done after flowering. The flowers appear on wood when it is one year old.

In sheltered gardens with good treatment cydonia japonicas (*Pyrus japonica*) have been a mass of glowing colour of many kinds. Sometimes the display has been discounted and obscured by leafy growth caused by pruning back young growth to wood buds. In building up the bushes this may be necessary, but afterwards it makes them unnecessarily dense and is detrimental. These vigorous plants flower on the old wood, and successful pruning lies in thinning out the growth altogether rather than shortening it.

The season for garden-making commences with the month of February. To be successful the plans must be well thought out, and preferably plotted out on paper. To do it well the work must not be done hastily, but carefully considered and well proportioned, paying special attention to grades and levels. This is the secret of success. Whether work of this kind is to be done on a scale that is large or small the planning should be commenced now, making a feature of the selection and arrangement of the trees and shrubs.

Those interested in herbaceous plants will appreciate some notes taken from a contemporary overseas journal dealing with the new hybrid meconopsis (*Meconopsis Baileyi*), which is so much admired for its large pale blue flowers. The chief complaint regarding *M. Baileyi* appears to be its poor seed-germinating powers. Undoubtedly this is so if the seeds are sown in spring; they should be sown as soon as ripe—say, February or March—as the vitality deteriorates rapidly. They may be sown in boxes placed in a cold frame, or the seeds may be sown and raked-in in cool shady woodland border. During the winter they may appear as if they had damped off, although they have only gone to rest, and will readily commence to grow in the spring. The plant is quite hardy.

—*W. C. Hyde, Horticulturist, Wellington.*

WEATHER RECORDS: OCTOBER, 1930.

Dominion Meteorological Office.

THE past month was, for the country as a whole, the coldest October experienced in New Zealand since the accurate recording of temperatures commenced. From all parts of the country came accounts of the coldness and backwardness of the season. October is the month in which pastures usually show rapid growth after the semi-dormant winter period, but this year the growth was reported as very poor in most districts. The stormy weather experienced during the month added to its severity. The adverse conditions as regards growth of vegetation were accentuated also, so far as most eastern districts are concerned, by lack of sufficient precipitation In consequence, stock were generally in a somewhat backward condition. Frosts occurred on several days over large parts of the Dominion, and in some cases they were severe. A certain amount of damage was consequently caused to orchards and small crops, but, generally speaking, it does not appear to have been severe.

Rainfall.—Precipitation was greater than the average on the west coast of the South Island, over most of Otago, and in scattered parts of the western districts of the North Island, especially around Auckland. Elsewhere there was a deficiency. Even in Central Otago some parts had less than the average amount. In North Auckland, and the East Cape, Gisborne, Hawke's Bay, and Wairarapa districts, around Wellington, and in Nelson, Marlborough, and North Canterbury the month was a very dry one

Snow fell on the ranges on the 14th, 17th to 19th, 22nd, 23rd, and 25th. The falls which occurred at various places on the 17th, 18th, and 19th were the heaviest, and extended to low levels in parts of the South Island Hailstorms were frequent at many places.

Temperature.—As has been mentioned, temperatures were generally lower than had been recorded for the month hitherto in New Zealand. At Napier, Hokitika, and Dunedin one slightly colder October has been experienced, but at all other stations this year's was the coldest. It is noteworthy that the present spell of subnormal temperatures has lasted, with only short breaks, over most of the country since June, 1929.

Storms and Pressure Systems.—At the beginning of the month a deep depression was located to the east of the Dominion, and strong southerly winds and very cold temperatures prevailed during the first three days. A series of depressions of the westerly type followed These caused squally and showery weather in western districts, more especially of the South Island, where the rain was heavy. Hailstorms were rather frequent.

On the 13th a deep cyclonic depression developed at the eastern entrance to Bass Strait, and, moving eastwards, crossed North Auckland on the 15th. A secondary followed it on the 16th Heavy rains fell on the 14th or 15th over most of the North Island.

This depression passed eastwards, but on the 17th commenced to deepen in the neighbourhood of the Chatham Islands. From the 17th to the 19th strong southerly winds and cold weather prevailed in consequence. The southerlies reached strong gale force in places, and on the 19th some damage was done at Christchurch. There was much snow on the higher levels, and thunder and hail in places

Another spell of westerly weather followed, but pressure remaining low to the east, winds were more frequently from south of west than north of it. On the 22nd and 23rd very boisterous conditions prevailed. Damage was done by westerly gales in the Taranaki Bight on the 22nd. Further snowfalls occurred on the high levels.

A depression which crossed the Dominion on the 24th developed a cyclone in its northern portion, and on the 25th this was centred east of Hawke's Bay. The west to south winds in its rear were again particularly severe Rain was widespread, many heavy falls being experienced. The 25th was the worst day, and considerable damage was done at Auckland. Snow fell on the ranges. On the 26th there were severe thunderstorms from Auckland northwards, and at Kaitaia a small tornado developed from one of these.

A vigorous westerly depression crossed the South Island on the 30th and 31st, causing heavy rain in western districts.

RAINFALL FOR OCTOBER, 1930, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	2·13	18	0·64	5·98
2	Russell	1·83	8	0·96	4·44
3	Whangarei	2·00	20	0·41	5·04
4	Auckland	6·11	20	1·23	3·71
5	Hamilton	4·56	16	1·00	4·77
5A	Rotorua	2·95	13	0·85	5·40
6	Kawhia	5·84	18	1·28	5·24
7	New Plymouth .. .	5·27	22	0·89	5·62
8	Riversdale, Inglewood ..	7·81	20	1·36	10·54
9	Whangamomona	6·63	16	1·23	8·64
10	Eltham	3·98	15	0·70	5·00
11	Tairua	7·18	13	2·60	5·99
12	Tauranga	4·17	11	1·16	5·44
13	Maraehako Station, Opotiki	4·92	17	1·88	5·51
14	Gisborne	1·22	9	0·43	2·77
15	Taupo	2·93	14	0·62	4·46
16	Napier	1·37	14	0·76	2·28
17	Hastings	0·73	14	0·23	2·32
18	Taihape	4·28	21	0·37	3·86
19	Masterton	2·91	20	0·48	3·36
20	Patea	3·48	15	0·70	4·29
21	Wanganui	4·38	14	0·87	3·48
22	Foxton	2·39	15	0·47	3·11
23	Wellington (Karori Reservoir)	1·52	13	0·23	3·81
	South Island.				
24	Westport	14·30	22	3·16	8·70
25	Greymouth	13·30	21	2·48	10·32
26	Hokitika	13·27	21	3·38	11·81
27	Ross	17·98	18	5·39	14·69
28	Arthur's Pass	16·04	12	5·93	20·93
29	Okuru	16·52	8	7·48	15·76
30	Bainham	9·56	20	3·99	15·82
31	Nelson	2·04	8	0·64	3·54
32	Spring Creek, Blenheim ..	0·78	15	0·16	2·63
33	Tophouse	4·12	14	1·46	5·68
34	Hanmer Springs	2·21	14	0·38	3·60
35	Highfield, Waiau	1·48	10	0·22	2·81
36	Gore Bay	1·51	13	0·40	2·20
37	Christchurch	1·01	16	0·19	1·70
38	Timaru	1·44	13	0·40	1·95
39	Lambrook Station, Fairlie ..	2·06	7	0·80	2·03
40	Benmore Station, Clearburn	1·60	11	0·54	2·15
41	Oamaru	2·47	12	0·61	1·74
42	Queenstown	1·74	12	0·52	3·45
43	Clyde	1·62	10	0·51	1·62
44	Dunedin	4·92	21	0·84	3·16
45	Wendon	3·70	15	0·75	2·81
46	Gore	..	..	..	3·28
47	Invercargill	4·59	22	0·76	4·56
48	Puysegur Point	10·98	25	2·07	8·13
49	Half-moon Bay	4·89	20	0·77	5·37

—*Edward Kidson, Director of Meteorological Services, Wellington, 6/11/30.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

HORSE WITH BACK SORE.

"FARMER," Hawera :—

Kindly inform me how to cure a horse with a sore back caused by an ill-fitting saddle. The place swelled up and finally burst, and is now a sore about 1½ in. long, which I find very hard to heal.

The Live-stock Division :—

Without an examination of the animal it is rather difficult to locate the seat of the sore. If in the region of the withers a rather serious condition often results. This is known as fistulous withers, and is very difficult to treat successfully without a surgical operation. On the other hand, the sore may be an ordinary saddle-gall, which responds to treatment much more easily. First remove all pressure from the seat of the sore, either by discontinuing the use of the saddle or using a chambered saddle. Hot fomentations should be applied at frequent intervals to remove all pus and scab. It may be necessary to slightly cauterize the edges of the wound to stimulate healing. Cleanliness and the use of antiseptic solutions are necessary to assist recovery

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DEFICIENCY OF SOLIDS NOT FAT IN MILK.

"MILKY," Greenmeadows :—

I would be obliged if you could explain why milk is sometimes deficient in solids other than butterfat when the test is 4·4 per cent. and no water has been added. I had a sample of milk analysed, and it contained 5·4 per cent. of fat and 9·1 per cent. of other solids, while a neighbour with a lower test (5 per cent.) had a greater percentage of other solids (9·3 per cent.). In the case of milk containing less than the law allows of other solids, how could it be remedied ?

The Dairy Division :—

It is generally considered that, provided all other things are equal, any deficiency in the solids not fat in milk of 4·4 per cent. fat content or other percentage is to be attributed to characteristics inherent in the cow. These characteristics are to a large extent influenced by the individuality and breeding strain of the cow. Furthermore, solids not fat do not bear any set relation to the fat content. When the solids not fat in milk fall below the statutory requirements a way out of the difficulty is to mix the milk with some which is richer in solids not fat. In some cases this may possibly be effected by retaining for use on the farm a portion of the milking known to be poor in solids not fat. Relief can be got by feeding concentrates, but it is only of a temporary nature. Solids not fat may decline rapidly during brief periods of drought and recover on return of succulent green feed.

VARIATION IN CORE-COLOUR OF MAIZE.

J. F. ROLLEY, Marohemo :—

Would you kindly inform me as to the cause of white-cored maize appearing in a crop of maize the majority of which has red cores. Is it a different variety, or does the quality of the soil influence the shade or colour of the core ?

The Fields Division :—

Core-colour in maize shows a good deal of variation. With some exceptions, red or yellow varieties of maize have a red core, and white varieties a white core. In some varieties in which there has been remote or recent cross-fertilization

cores of mixed colour are to be found. A variety of maize with red cores may show up to 10 per cent. of white cores, even though red cores only have been selected for seed for many years. This may be caused by recent cross-fertilization, or by the fact that in the original red-cored stock the red characteristic was an impure dominant. The case you mention of white cores appearing in a crop the majority of which has red cores may be due either to the original red characteristic being impure or to recent cross-fertilization The difference in colour is not connected with soil variations.

SMALL BIRDS AND SURFACE-SOWN GRASS-SEED.

K. A. McKenzie, Martinborough :—

Can you tell me any method of preventing small birds from eating surface-sown grass-seed ? The birds here are so numerous that out of about £20 worth of mixed seed I sowed last autumn in scattered patches of burnt scrub I am satisfied they did not leave a dozen seeds to the square yard I tried turpentine on the seed, but it killed the seed, or a lot of it, and did not stop the birds. I should like to know about the red-lead method

The Fields Division :—

It is extremely difficult to prevent small birds from eating grass-seed. Red-lead has been used as a prevention in connection with the depredation of turnip, rape, and clover seeds by birds, and is recognized by some as successful. The usual method is to mix sufficient red-lead dust with the seed to give a coating. The intention is to so obscure the seed that the birds do not recognize it, but it does not act as a poison and does not injure the seed. A treatment that has been found successful by some is as follows. Mix turpentine and kerosene in the proportion of 1 pint turpentine to 1 gallon of kerosene When sowing, tip about ½ bushel of seed into the sowing-bag, then pour ½ pint or a little more of the mixture over the seed, stirring the latter well at the same time. The seed will not get sticky unless too much of the mixture is used

PLOUGHING IN LUPINS BEFORE TURNIPS.

H. L. B., Ashburton :—

If advisable, I propose to plough in for green manure a paddock of blue lupins, and then drill turnips. As the lupins have only recently been drilled I do not expect them to be sufficiently advanced for ploughing under until about the middle of December. As the best time for drilling turnips in my locality is about the New Year, please advise whether you think this plan advisable. My soil is light and easily worked.

The Fields Division :—

To plough lupins under about the middle of December and follow with turnips at New Year would not be good practice It is found that lupins, even under the best of conditions, take at least six weeks to decay, and in some soils much longer. We have seen turnips and beetroot sown on land into which lupins, and oats and vetches had been dug, but had not decayed ; results were most unsatisfactory. Under your conditions of soil, if you can plough the lupins in about the beginning of December and follow about the second week in January with Hardy Green Globe turnips results will probably be satisfactory.

THE SEASON'S LAMBING : NORTH ISLAND ESTIMATE.

From information furnished by Inspectors of Stock in the various districts the average lambing for the current season in the North Island is estimated at 83·19 per cent., compared with 87·56 per cent. last year. With 9,312,461 breeding-ewes in the North Island, as shown in the 1930 sheep returns, the number of lambs this season is estimated at 7,747,274. South Island and Dominion estimates will appear in next month's issue of the *Journal*.

ESTIMATED AREAS UNDER CEREALS AND POTATOES.

The following estimates of the areas under wheat, oats, and barley in the Dominion for the current season were issued by the Government Statistician at date 4th November, the figures being based on a card census. Wheat, 243,000 acres; oats, 322,000 acres; barley, 25,250 acres. The corresponding final totals for the preceding season (1929–30) were 238,653 acres of wheat, 282,814 acres of oats, and 18,631 acres of barley. Wheat, therefore, has an estimated increase in area this season of 4,347 acres, oats an increase of 39,186 acres, and barley an increase of 6,619 acres.

Also from a card census and at date 4th November the Statistician estimates this season's area under potatoes as 24,000 acres. The corresponding final figures for the 1929–30 season were 23,214 acres. Reckoned on the average of the last five seasons—5·56 tons per acre—the total yield from this season's area would be 133,500 tons, as compared with a total actual yield of 130,107 tons for 1929–30. Only holdings of 1 acre and over outside borough boundaries are covered by these figures; a fair aggregate area of potatoes is also grown on smaller holdings and within boroughs.

FERTILIZER IMPORTATIONS.

Following are particulars of importations of fertilizers into New Zealand for the six months ended 30th September, 1930:—

Sulphate of ammonia: United Kingdom, 3,745 tons. *Cyanamide, nitrolim, &c:* Norway, 30 tons. *Nitrate of soda:* Chile, 754 tons. *Basic slag:* United Kingdom, 1,878 tons; Belgium, 17,437 tons; France, 10 tons; Germany, 4,641 tons; Luxemburg, 153 tons. *Bonedust:* India, 925 tons. *Guano:* United Kingdom, 10 tons, Seychelles, 7,915 tons. *Rock phosphate:* Nauru and Ocean Islands, 72,750 tons; Tuamotu Archipelago, 7,889 tons. *Phosphates (other):* United Kingdom, 1,135 tons; Belgium, 5,706 tons; France, 50 tons; Netherlands, 700 tons; Morocco, 717 tons. *Kainit:* France, 143 tons; Germany, 388 tons. *Muriate of potash:* France, 35 tons. *Sulphate of potash:* France, 400 tons; Germany, 531 tons. *Potash (other):* France, 1,525 tons; Germany, 2,408 tons. *Sulphate of iron:* United States, 1 ton. *Other fertilizers:* United Kingdom, 592 cwt.; Germany, 59 cwt.; Netherlands, 30 cwt.

INVENTIONS OF AGRICULTURAL INTEREST.

Applications for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 25th September to 6th November, 1930, include the following of agricultural interest:—

No. 62700: Milking-machine; F. A. Stempa, Invercargill, and others. No. 63432: Potato-grader; G. E. R. Kingsbury, Willowbridge. No. 63538: Apparatus for collecting grass-seed; D. A. Hawken, Maungatapere. No. 64387: Hay-sweep; S. Armstrong, Frankton Junction. No. 64498: Hay-sweep; E. C. Houchen, Hamilton. No. 65054: Swingletree-bar; H. V. Dyke, Auckland. No. 65486: Plough-lifting device; C. Stokell, Prebbleton. No. 63902: Manure-sower; J. B. Whisker, Netherton. No. 63915: Manure-distributor; J. Souter, Pongaroa. No. 63948: Hay-sweep; Booth, MacDonald, and Co., Ltd., Christchurch. No. 64137: Sheaf-elevator; J. H. Campbell, Balcairn. No. 63580: Manure-sower; Booth, MacDonald, and Co., Ltd., Christchurch. No. 63689: Milk or cream cooler; G. P. Dyer, Dunedin. No. 63768: Phosphatic product; W. C. Gentles, New Plymouth. No. 63868: Teat-cup inflation; F. J. Foote, Graham's Beach, via Onehunga. No. 62803: Teat-cup; D. F. Watson, Waitoa. No. 65062: Manure-distributor; A. Storrie, Auckland. No. 65243: Vacuum-tank for milking-machine; D. M. Wallace, Ltd., Te Aroha. No. 65671: Device for dosing animals; B. J. O'Donovan, Laggan, N.S.W., and others.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

The New Zealand

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STRAIN INVESTIGATION OF GRASSES AND CLOVERS.

(Continued.)

E. BRUCE LEVY, Agrostologist, and WM DAVIES*, Plant Geneticist, Plant Research Station, Palmerston North.

3. RED CLOVER (Trifolium pratense).

RED clover occupies an important place in grass-farming the world over, and the type now dominant in world markets would indicate its greatest function to be in temporary and short-rotation pastures. For purely temporary pasture work rapid-establishing and high-producing but short-lived types of red clover have been evolved, and for the temporary pasture this type is what is required. The South European, French, and Chilean red clover on the market are of this type, and are suitable only for one-year pastures. For the short-rotation pasture of two- or three-year leas rapid establishment and quick production is similarly required, but there is not quite the same call for rapidity of establishment.

The typical broad red clover has apparently been evolved under years of short-rotational farming. All New Zealand red clover is essentially of this normal broad red type, although there are indications that New Zealand Broad Red is slightly longer-lived than the ordinary European red clover of this type. Our trials in New Zealand and those at Aberystwyth, Wales, however, would indicate that New Zealand Broad Red and the English Broad Red are almost identical in type. The point, however, that we wish to make perfectly clear is that broad red clover the world over is characteristically a short-lived type evolved under a short-rotation system of farming. For such conditions one does not require high persistency, but moderately quick establishment; early spring growth, heavy hay-yields, and good summer aftermath production are essentials. Such pastures are regarded more or less purely as supplementary feed crops and as an integral part of rotational farming.

Nowadays, however, with high renewal costs and the ever-increasing practice of top-dressing, the trend is definitely for long-rotation and truly permanent pasture. The big question before the research worker is whether he can produce and make available to the grassland farmer

* Member of staff of Welsh Plant Breeding Station, Aberystwyth, seconded to Plant Research Station, Palmerston North.

a red clover that can take its place and hold it indefinitely in a mixed sward of rye-grass, cocksfoot, timothy, crested dogstail, white clover, &c. There is a place for a red clover in the permanent pasture, but it must be a type that will persist and blend in with the other dominant species. The broad red sown to-day is in many respects dangerous to include in a permanent sowing. It establishes rapidly, and produces in the first year an enormous bulk of herbage that quite overshadows and smothers much of the truly permanent elements such as perennial rye-grass, crested dogstail, white clover, &c.; then in the second year its yield rapidly falls off, the plants die, and a weak, open, poorly constituted pasture is left to carry on. An ideal permanent-pasture red clover should not establish more rapidly than the other constituents of the mixture, and it should blend in and harmonize with these other constituents, yielding a seasonal quota of feed when the other species are at a low stage in production.

It may be asked for what period of the year is red clover desired in the pasture. We are of the opinion that red clover will best fit in during that period from the falling-off of the rye-grass and white clover shortly after December until the recovery of these when the weather has definitely broken in the autumn. In this critical period red clover should fit in together with cocksfoot or paspalum. The extra-late-flowering red clover types, such as Montgomery or Cornish Marl, are more likely to fill this role than any early-flowering type such as the ordinary broad red clover. The Montgomery Red, with its lower-set and more densely tillered crown, is structurally more fitted to persist under grazing conditions than the open-crowned, few-tillered broad red types. Finally, it would appear that if a red clover is ever to be introduced into our permanent pastures the hope of success lies very much more definitely in Montgomery Red than in any other type, and the trials in New Zealand with this clover up to the present would certainly indicate that some measure of success in this is assured.

Another important point to bear in mind is the need to cater for export requirements. Great Britain is probably our greatest potential buyer of red-clover seed, and her requirement for a persistent red clover is more specific than our own. In New Zealand, with its milder winters and autumns that favour comparatively easy re-establishment from seed shed, persistent strains would appear to be less absolutely essential. In Great Britain, particularly in Western and Northern districts, there is less chance of autumn re-establishment and a greater degree of winter killing than with us; highly persistent, truly permanent types are what Britain is likely to demand in the near future. The once-growing in New Zealand of the Montgomery Red type, and the export of this to Great Britain, would greatly help to consolidate the red-clover-seed trade between the two countries.

We do not advocate abandoning the growing of broad red clover in New Zealand, but rather of adding Montgomery Red as a special type, keeping in mind always that as the world demand for a truly permanent red clover expands so should our crops of this increase in order to cater for that demand.

Red clover is a particularly interesting species, and provides an example of how environment, natural or modified to suit human purpose, selects out the type best fitted to survive for the particular end

FIG I. NEW ZEALAND BROAD RED CLOVER.

Single plant, showing lax and stemmy growth, with general openness of crown. Age, six months. Early-flowering in comparison with Figs 3 and 4

FIG. 2. NEW ZEALAND BROAD RED CLOVER.

Single plant, showing denser crown and less proneness to stem and early-flower production. Age, six months. Best broad red plant in experiment.

[*Photos by H. Drake.*

in view. The extremely low-production, prostrate, small-leaved, wiry-stemmed wild forms are the outcome of an environment peculiar to the very old pastures of Great Britain. Montgomery Red and Cornish Marl are types cultivated respectively in the long-rotation pastures of certain parts of Montgomeryshire and Cornwall. The late red group, as represented by Hersnap and Altaswede, are intermediate between Montgomery and typical broad red, and, judging from their behaviour in New Zealand, are intermediate in demand of environment between these two major groups. The broad red is plainly the outcome of arable and short-rotation farming, where the more tardy establishers and lower early-yielders are rapidly eliminated, either by the smother or by the fact that their seed does not ripen simultaneously. The extreme broad red type is represented by certain French, Chilean, and Italian types, such as Lombardy red clover. This latter type was the first to establish in our trials, and during the first year it was always ahead of any other type. In the second year, however, it failed badly, and was the first to go out under our mowing trials.

In the hands of a skilled plant-breeder it would appear that a red clover for any soil and condition could ultimately be evolved and while many types may be useless as competitors with species already filling a definite role in our grasslands there are still unfilled places that could well be filled by certain types of red clover.

Major Types of Red Clover compared.

Red clover surveyed as a species falls into four main groups: Broad red, late red, extra late red, and wild red. It will be convenient to discuss briefly in the light of overseas experience each of these four main types.

BROAD RED CLOVER.

This type is also called early-flowering red clover, cow-grass, and double-cut cow-grass. The broad red group is the least persistent of all the red clovers; it grows rapidly from seed and tends to produce excessive smother during the early growth periods. This early smother by broad red is certainly limiting the use of red clover in many parts of New Zealand, where the successful establishment of permanent grass is the objective, and where it is therefore essential that excessive smother by any one species shall not take place.

Broad red clover flowers earlier in the season than late red clover, but normally little or no seed is set in the early part of the season, due largely to absence of humble bees at this period. A second crop of flowers is produced in early autumn, when seed is set in abundance, and it is at this time that the seed crop is taken in practice.

The average type of plant common in broad red clovers is typically lax at the crown at all stages of growth, relatively few-tillered, and producing stem rather than leafy growth, especially at mid-season (see Figs. 1 and 2). This inherent laxity in growth-form of the plant in broad red becomes apparent in quite early seedling stages, and can at that time be made use of as one of the diagnostic characters distinguishing the broad from the late-flowering red clovers. New Zealand red clover is characteristically a broad red clover.

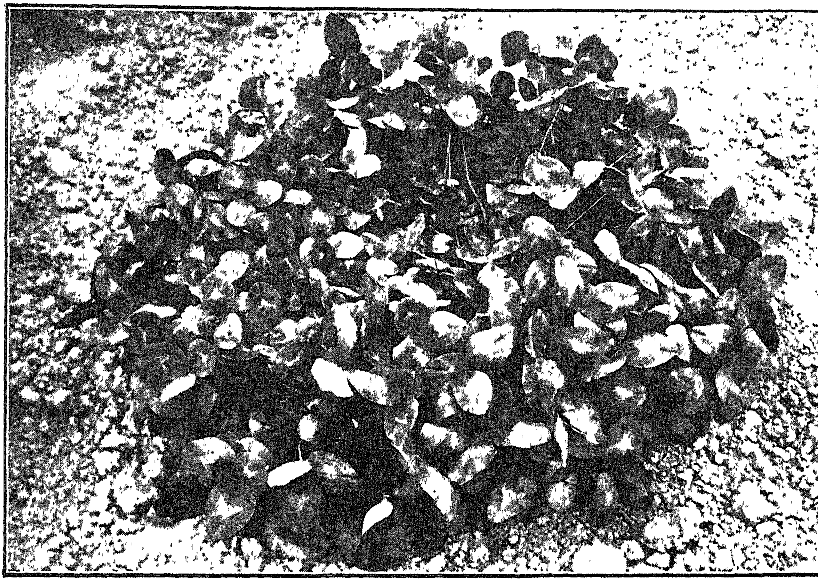


FIG. 3 LATE RED CLOVER

Single plant ex line Altaswede, showing denser and more leafy growth. Age, six months. Plant not yet commenced to flower.

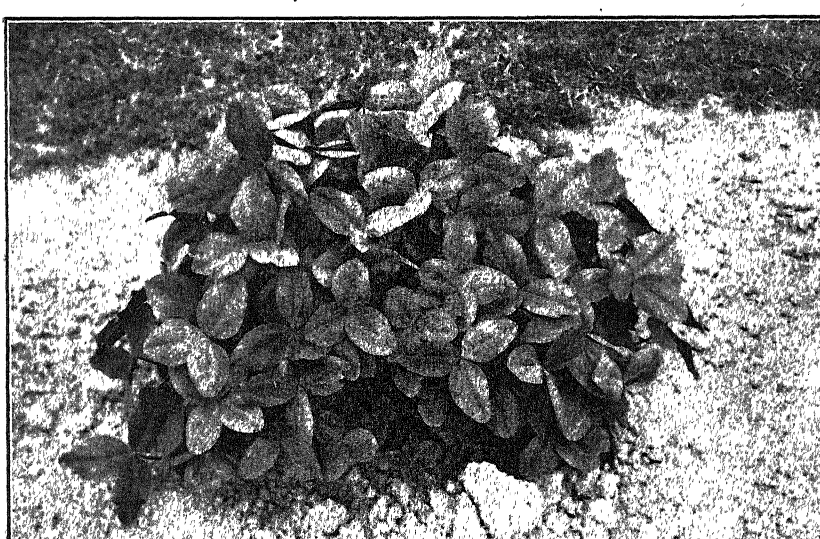


FIG. 4. LATE RED CLOVER.

Single plant ex line Altaswede, showing dense dome form. Age, six months. This type showed virtually no winter growth in 1930.

[*Photos by H. Drake.*

ORDINARY LATE-FLOWERING RED CLOVER.

Ordinary English late, Swedish late, Danish, and other North European and North American lates come into this group. A few plants in some lines of New Zealand red clover can probably be best placed in this group, but on the whole the Dominion's red clover is typical broad red. Late red clover normally flowers rather later in the season than broad red and is more persistent, lasting two to three seasons in Britain as against one to two seasons in the case of the broad red.

Late-flowering red clover plants when studied individually are fairly dense at the crown, and tiller better than the broad reds. Normally only one full crop of bloom is produced per annum. If allowed to mature at mid-season a second crop of flowers is not produced; but if grazed late into spring the flowering period is delayed, and this course is the normal practice when the crop is grown for seed. The leafy rather than the stemmy aftermath makes late-flowering red clover a better grazing-plant than broad red from mid-season onwards. Types of plants common in ordinary commercial lines of late red clover are shown in Figs. 3 and 4, but most samples of seed contain small proportions of plants belonging to broad red.

EXTRA-LATE-FLOWERING RED CLOVER.

There are two well-defined commercial strains belonging to this group—the true Montgomery and the true Cornish Marl red clovers. Both of these are British local varieties, the former long cultivated in the Welshpool district of Montgomeryshire on the English-Welsh borders; Cornish Marl is similarly largely localized to the Wadebridge district of North Cornwall. These varieties are closely allied the one to the other. A few plants found in certain Scandinavian and Russian late reds closely resemble the Montgomery-Cornish Marl type in growth-form. Extra late red as a group is considerably more persistent than either of the two first groups discussed and is a more promising pasture type for New Zealand conditions, apparently being much more persistent here than in Britain. The type of plant predominating in this group may be judged from Figs. 5 and 6, though there is considerable variation between individuals in any given line. The type is slower to establish from seed than either broad or ordinary late red, and therefore does not produce that rapid flush of seedling growth so characteristic of the former. The English experience is that the mid-season growth is heavier in Montgomery Red than in broad red.

Only one crop of flowers is produced during the year; an area designed for seed must therefore be grazed until early summer and the seed crop taken in the autumn at the usual time.

ENGLISH WILD RED CLOVER.

Seed of this type is commercially available in England to a limited extent. It is there indigenous to very old grasslands, but the type does not appear to have reached New Zealand in any quantity — at least, it has not become established as a constituent of old pastures in this country.

As might be expected, wild red clover is an exceedingly heterogeneous group. As a whole, the type is low in total production and extremely

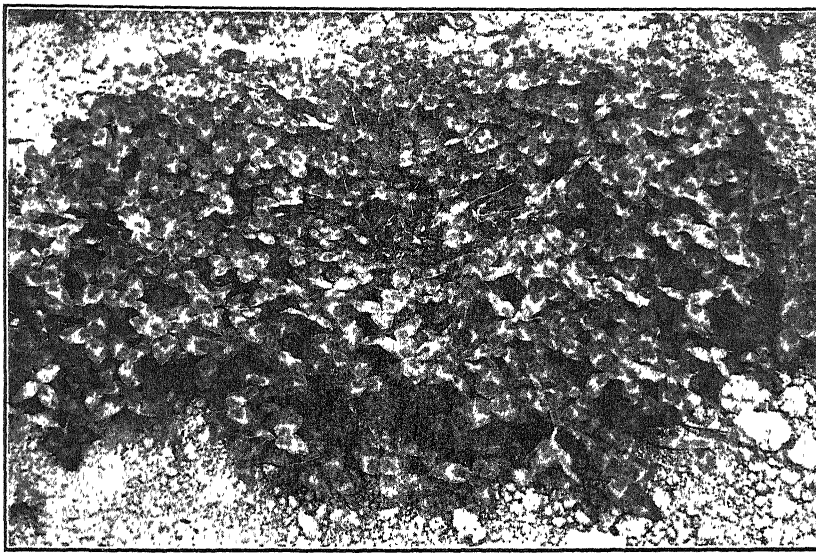


FIG. 5. EXTRA LATE RED CLOVER, MONTGOMERY TYPE.

Single plant, showing prostrate dense leafy growth, and low-set many-tillered crown. Age, six months. This type is highly persistent and best suited for permanent-pasture sowings.

FIG. 6. EXTRA LATE RED CLOVER, MONTGOMERY TYPE.

Single plant, showing slightly laxer form, and not quite so dense as Fig. 5. Age, six months.

[*Photos by H. Drake.*

variable in time of flowering, persistency, growth-form, and leafiness. Many of the forms tend to be very dense though diminutive plants, and it may be possible to isolate types to fill special requirements as, for example, for use on hard sheep-country.* It may also well be that very highly persistent forms of wild red exist, and that these can be used for crossing with cultivated varieties with a view to increasing the persistency of the latter. Extended trial of this type in New Zealand is a project which the Plant Research Station has in hand.

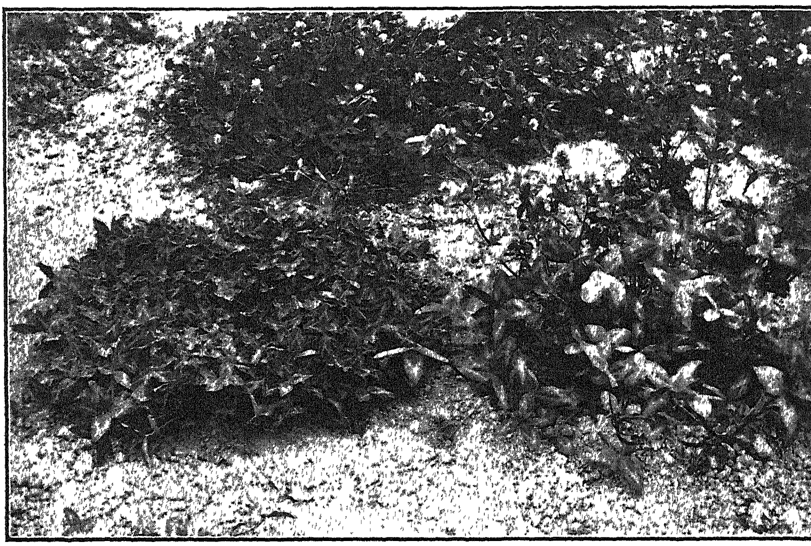


FIG. 7. EXTRA LATE RED CLOVER (ON LEFT) AND BROAD RED CLOVER (ON RIGHT) GROWN SIDE BY SIDE.

These plants show the difference in growth-form and type between these two major groups. Age, six months.

[*Photo by H. Drake.*

Red Clover Trials conducted at the Plant Research Station.

Three series of trials have been initiated at the Station in connection with strain studies in red clover. These are as follows :—

(1) Broadcast plot trials at the Station area and under normal grazing in the field (the latter in conjunction with the Fields Division). These trials are supplemented by additional trials laid down by Mr. J. W. Deem at the Marton Experimental Area during the period 1926 onwards.

(2) Spaced-plant studies at the Station area, laid down during the past eighteen months.

* In this connection it may be of interest to refer to experiments conducted on the property of Mr. S. M. Bligh, Cilmery, Wales, and with which one of the writers was concerned. These showed that wild red clover responded to phosphates to a remarkable degree and considerably assisted in the improvement and cropping-capacity of the sward.

(3) Intensive trials with specific growth-forms of red clover, with a view to defining with some degree of accuracy which types of plants, irrespective of their country of origin, are likely to be most useful under New Zealand conditions. These trials have been designed under a triple system of management, and, since they have only recently been started, no useful report can yet be made, and no further reference is made to them in this article.

(1) Broadcast Plots.

The broadcast plot trials at the Plant Research Station were sown in spring of 1928 in duplicate, the plots being approximately $\frac{1}{1800}$ acre. Sixty-five lines of specific New Zealand origin were dealt with, and an additional thirty-nine lots of red clover from overseas. The overseas lines included lots from various English counties, from Canada, United States, Chile, Italy, Poland, Russia, Czecho-Slovakia, Switzerland, France, Norway, and Sweden, as well as defined types from the Welsh Plant Breeding Station, Aberystwyth. After the plants were properly established the plots were each divided transversely into two sections; one section was cut weekly with a lawn-mower, the second section was under a system of infrequent cutting, being tantamount to young hay or ensilage. No reseeding was allowed to take place on any of the plots. Observations and notes were made at intervals, but no weights were taken. The state of fertility was kept at a fairly high standard throughout the experiment by means of fairly frequent dressings of superphosphate and ammonium sulphate. Analysis of the swards by the point-quadrat method was made when the plots were nine months down, and again exactly a year later.* The observations made on the plots confirm in general the results obtained by overseas workers in red clover variety trials.†

BEHAVIOUR OF THE VARIOUS GROUPS, SEASONS 1928–1930.

Broad Red.—Under drastic (= weekly) cutting with a lawn-mower the broad reds more or less completely disappeared in about six months after the commencement of this treatment. The lots of ordinary late-flowering persisted considerably better, even after twelve months' cutting, but these did not show nearly as good persistency as the Montgomery and Cornish Marl strains (see Table 1). The number of oft-repeated cuttings which a plant or group of plants can withstand is in direct ratio to the relative persistency of those plants. Thus the type that can stand up to and persist longest under a system of weekly cutting is likely to prove the most persistent under any given system of grazing or depasturing.

Under "hay" conditions (= infrequent cutting) the broad reds have persisted quite well and have yielded to date better than any other clover type under trial. (Table 2.)

The one striking exception is a line of Italian broad red clover, which is now thinning out very rapidly (two years after sowing) and is apparently not likely to hold much longer even under the most lenient

* All point-quadrat analyses made by Mr. E. A. Madden, Assistant in Agrostology.

† For summary of position in Britain and for a wide range of references to other workers in this subject see R. D. Williams, Red Clover Investigations, Bull. H. No. 7, Welsh Plant Breeding Station, Aberystwyth, Wales, 1927.

cutting. Under weekly cutting this line was the first broad red to be killed outright. These results are confirmatory of the British and American work, which showed Italian red clover to be the least persistent of commercial reds in those countries. French, Chilean, and Swiss Mountain red clovers are all thinning out considerably on the hay plots (third spring), while New Zealand, English, Canadian, and Czecho-Slovakian broad reds are all apparently lasting well and show but little signs of weakening in the hay plots. All the broad reds have more or less completely disappeared in the "weekly cut" sections.

Productivity in the broad reds has been satisfactory during the period under review. They have made some winter growth over the two seasons, Italian red being of outstanding merit in this respect during its first winter and also during the first part of the second winter. Growth in the broad reds, however, was always lax and tall rather than dense and short, while during mid-season there was a proneness to stem-production and a consequent reduction in production of leafage.

Ordinary Late Red.—This group was more persistent under weekly cutting than the broad red group. In the hay plots it persisted well to the end of the second year (end of first harvest year) without any show of thinning out. In production the lates up to the present have not equalled broad red. As broadcast plots the former were never completely dormant, although as single plants two lines of ordinary late-flowering—Swedish Hersnap and Canadian Altaswede—were completely winter dormant and did not make early spring growth, being surpassed in this latter respect both by New Zealand red and Montgomery and Cornish Marl reds Swedish Hersnap and Canadian Altaswede, however, are persisting better in the third year than the ordinary late reds, approaching in this respect closer to the extra late red type.

Extra Late Red.—These types proved considerably more persistent than either late red or broad red under the system of weekly cutting. Montgomery and Cornish Marl reds have persisted well in the hay plots, at all times giving a dense cover of close-growing leafage. The yield under hay, however, has for the two years down been less than in normal broad red. Spring growth in the extra late types did not commence in our trials at the Station before the beginning of October, whereas New Zealand broad red started growing in early September—a month before.

At the Marton Experimental Area Montgomery and Cornish Marl red clover sown in 1926 in a mixture with other grasses and clovers and subjected to normal management in the field have persisted very well (four years), while the control plots sown with New Zealand and with imported broad red had completely died off by the autumn of 1929 (two years and a half after seeding). Under very close and intensive grazing with sheep on the same field none of the red clovers lasted as long as where grazing was less severe; but here again Montgomery Red has persisted better and for a longer period than any of the broad reds. Recent point-analyses of these plots show total death of all broad red lots, while Montgomery Red and Cornish Marl were at the time of analysis constituting over 10 per cent. of the pasture.

Wild Red.—Only one sample of English wild red clover was tested in the 1928 broadcast trials. This line proved to be low in production

at all times during the experiment, formed a dense prostrate plant with dark-green foliage, and flowered abundantly at mid-season even in the weekly-mown section. The flowers were decumbent, being produced almost at ground-level. This line did not show a high degree of persistency, but the few plants that have persisted are very dense and healthy. This type may have a limited scope on hill country and land too hard for other types of red clover to hold on.

Table 1.—Relative Persistency of Red Clover Types at Plant Research Station Area, sown November, 1928 (Plots two years old.)

Extra lates = 100 in all cases.

Type.	Pasture = Weekly Cut.		"Hay."
	Estimation Method—Basis 0–10.	Point-quadrat Method	Point-quadrat Method.
Extra late red	100	100	100
Ordinary late red	43	43	101
New Zealand broad red ..	10	16	86
English broad red	8	16	87
Italian broad red	0		
Other broad reds	3		

Table 2.—Relative Production of Red Clover Types at Plant Research Station Area, sown November, 1928 ("Hay" Plots.)

Broad reds = 100 in all cases.

Type.	First Spring (9/10/29).	Second Autumn (26/5/30).
New Zealand broad red (sixty-five lines) ..	100	100
Imported broad red (nineteen lines) ..	100	109
Imported late red (fourteen lines) ..	88	54
Extra late Montgomery and Cornish Marl red (five lines)	87	69

(2) SPACED PLANTS.

Some 4,500 single plants are under close observation at the Station, and these make a very interesting study in relation to type and growth-form. Among all varieties there is considerable variation, and quite big possibilites for improvement by selecting and culling are manifest in any of the lots under trial. Perhaps the varieties offering the greatest possibilities in this direction are the extra late Montgomery and Cornish Marl. The commercial lines of these at present offering show marked variation, and while in the aggregate the type is distinct from any of the other major types, yet within the varieties there are possibilities of building by selection and culling to several main types. Before much work on type-building is done, however, much preliminary testing is necessary to learn which form best suits the purpose we have in view—that is, which form of Montgomery Red will persist best, and blend in and harmonize with the other major constituents of the permanent pasture.

PASTURE TOP-DRESSING IN CANTERBURY.

EXPERIMENTAL WORK BY THE FIELDS DIVISION.

(Continued.)

A. W. HUDSON, Crop Experimentalist, Plant Research Station, and
A. Y. MONTGOMERY, Assistant Crop Experimentalist.

PART III.—OBSERVATIONAL EXPERIMENTS ON BANKS PENINSULA, 1927–1930.

THE series of experiments here described was inaugurated in 1927 by Mr. J. W. Hadfield, Agronomist, Plant Research Station (then Instructor in Agriculture, Christchurch), and the present senior writer.

Largely owing to their somewhat isolated position and the cost of transporting manures, very few farmers on Banks Peninsula had attempted top-dressing. On account of cost of harvesting, cooksfoot-seed production is becoming relatively less important as an industry,

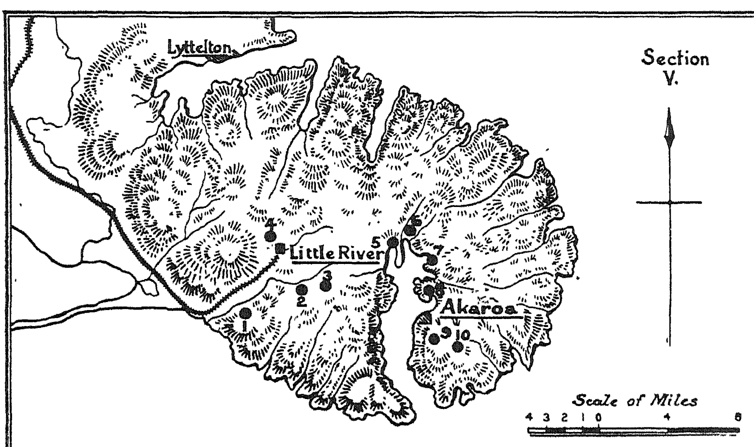


FIG. 12. MAP OF SECTION 5, SHOWING LOCATION OF EXPERIMENTS ON BANKS PENINSULA.

Each experiment is represented by a numbered dot.

and is giving further place to pastoral farming. Under the changing conditions of management the deterioration of pastures is making itself very apparent. With a view to getting a lead regarding the most useful lime or fertilizer applications to check this deterioration a series of observational experiments was laid down on different pasture types which were fairly representative of the Peninsula as a whole.

The soils of the Peninsula are mainly of volcanic origin, except on the western slopes, where a covering of wind-borne material (loess) is found.

Ten experiments were laid down, as shown in the accompanying map. The treatments in each case were as follows, the amounts being per acre in each case :—

(1) No manure
(2) Superphosphate, 3 cwt.
(3) Basic slag, 3 cwt.
(4) Basic superphosphate, 3 cwt
(5) Ephos phosphate, 3 cwt.
(6) 30-per-cent. potash salts, 2 cwt.
(7) Superphosphate, 3 cwt , plus 30-per-cent potash salts, 2 cwt.
(8) Ground burnt lime, ½ ton

All treatments were applied in the winter of 1927. Treatments 2 to 7 inclusive were redressed in 1928, 1929, and 1930. Burnt lime was used in Treatment 8 on account of transport costs. Treatments 1 to 7 crossed both limed and unlimed ground, as shown on the plan (Fig. 13).

Half the area was fenced from the rest of the paddock in each case, so that a complete set of treatments occurred inside the enclosure and a complete set outside. The enclosed portion was closed to facilitate observation, and in general the growth was cut for hay once each year

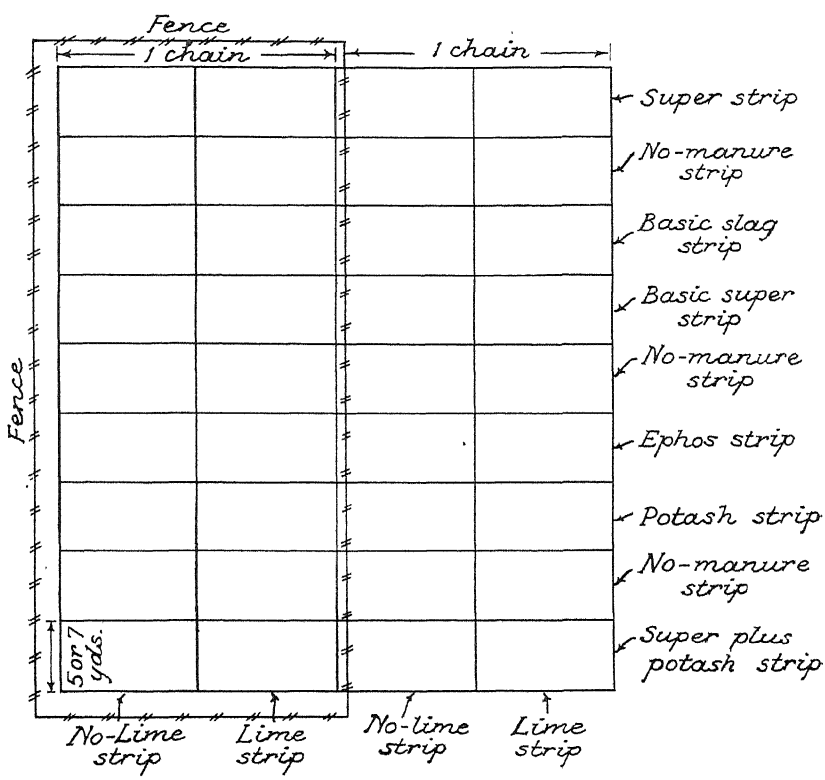


FIG. 13. PLAN OF STANDARD TOP-DRESSING EXPERIMENT LAID DOWN ON BANKS PENINSULA. (NOT TO SCALE.)

and grazed for the remainder of the season. In a few cases the enclosure was grazed only, on the system of intermittent grazing.

Notes on the Experiments.

I. FARM OF D. BARWICK

This farm is situated on part of the old Kinlock estate, on the drier country of the Peninsula, about 1,000 ft. above sea-level. The country is covered with tussock and associated grasses and clovers, chief of which are danthonia, cocksfoot, Yorkshire fog, rye-grass, goose-grass, hair-grass, and clustered, striated, white and suckling clovers. The pasture on which the experiment was laid had been ploughed many years before and, with the exception of tussock and danthonia, contained most of the species mentioned.

Responses to Lime and Manures.—Lime gave a slight but definite result. All phosphates stimulated the growth of clovers, particularly white clover.

Although superphosphate showed the first slight response basic slag was most pronounced in its effect subsequently.

At times basic slag and Ephos phosphate were the best plots, while at other times slag and super showed a superiority. Both slag and super gave better results on limed than on unlimed ground. Potash did not cause any visible difference.

It is problematical whether top-dressing of this country will prove highly paying. If done systematically, and advantage is taken of the increased carrying-capacity, no loss should result, and deterioration will certainly be checked.

2. FARM OF D. RICHARDS, OKUTI VALLEY.

This experiment was on somewhat similar though slightly rougher country than No. 1, at an elevation of about 700 ft. The chief species present were Poa tussock, Yorkshire fog, cocksfoot, danthonia, sweet vernal, and a little rye-grass with white and suckling clovers. Some rushes and a little bracken-fern were also present.

Responses to Lime and Manures.—Lime caused a slight but unmistakable increase in clover-growth. The manures were slow to show improvement, but did so quite definitely. Basic slag was most effective. Ephos and basic super appeared to be slightly more effective than super. Potash had no visible effect. The remarks regarding the question whether manuring would be profitable made respecting No. 1 also apply to this experiment. Fern is troublesome on this area, however, and the assistance of top-dressing in stimulating pasture-growth as an aid in the crushing-out of the bracken is an added reason for careful consideration and trial of top-dressing.

3. FARM OF J. G. WALLER, OKUTI VALLEY.

This experiment is situated higher up the Okuti Valley than No. 2, at an elevation of about 800 ft. The main constituents of the pasture are danthonia, sweet vernal, fog, cocksfoot, suckling clover, hair-grass, and catsear, with some rye-grass. This country was covered with manuka-scrub in its natural state.

Responses to Lime and Manures.—Lime caused an unmistakable improvement in clover-growth. The responses to slag and Ephos were quite outstanding in the first season. Super and basic super were very little better than no manure. All manures except Ephos were better on limed than on unlimed ground; the reverse was the case with Ephos. Slag maintained its superiority throughout, although in 1929 super gave good results on limed ground particularly. The chief responses were from white and

suckling clovers, with a thickening of the grass sward. On the unfenced portion a small amount of bracken-fern was in evidence. There were indications that there was less on the manured plots than on the surrounding unmanured ground.

Top-dressing here with slag should be profitable, and should assist in the control of bracken-fern.

4. FARM OF W. H. MONTGOMERY.

This piece of country was in bush originally. The main pasture constituents were cocksfoot, dogstail, white clover, Yorkshire fog, and rye-grass. Danthonia, sweet vernal, brown-top, and catsear were most in evidence on small dry knolls.

Responses to Lime and Manures.—Lime caused a definite though slight improvement in clover and the sward was generally better grazed. Super on limed ground was easily the best treatment during the first year. All phosphates except Ephos gave good results, however. Subsequently Ephos gave good results, but super and slag on limed ground have been consistently the best since the first season. On the unfenced portion, which was fairly continuously grazed, stock showed a preference for the phosphated plots, especially where they crossed lime. White clover responded best in the early stages, but cocksfoot, dogstail, and rye-grass have all been strengthened by the phosphate dressings, the result being a good close turf with less "flat" weeds, danthonia, and brown-top on the manured plots. Potash had no appreciable effect, although in November, 1929, Mr. W. H. Montgomery was of the opinion that potash on the limed ground had a slight effect on clover-growth.

5. FARM OF T. L. F. KAY, DUVAUCHELLE BAY (ONAWE).

Originally in bush, the field on which this experiment was laid down had been ploughed fifteen to twenty years prior to starting the experiment. The pasture was a comparatively good one, with cocksfoot, dogstail, Yorkshire fog, Poa pratensis, rye-grass, white and suckling clovers, rib-grass, and catsear as the main constituents.

Responses to Lime and Manures.—Lime showed an early improvement on clover-growth. The response to super was outstanding, especially on limed ground, and stock showed a marked preference for the herbage on this plot (Fig. 14). All phosphates improved the clover-growth, super being outstanding, with slag a close second. Both super and slag were decidedly better on limed ground. Potash did not appear to have any effect, either alone or in combination with super.

There can be no doubt about top-dressing paying on this country. With improved management and utilization of grass farmers cannot afford not to top-dress with lime and super or lime and slag.

6. FARM OF T. WAKELIN, DUVAUCHELLE BAY.

This experiment was about a mile from the preceding one, on a more run-out pasture and at a slightly higher level. The country was in bush originally. Sweet vernal, Yorkshire fog, cocksfoot, dogstail, danthonia, white clover, rib-grass, and catsear were the main pasture constituents, with some rye-grass.

Responses to Lime and Manures.—Limed plots were better grazed and contained more clover than corresponding unlimed plots. Super showed the most rapid response in the first season, and was better grazed than the other plots (Fig. 15). Sweet vernal and Yorkshire fog seeded abundantly on the no-manure plots, but the plants were readily eaten on the super plots, and comparatively few seed-heads were allowed to develop. Ephos had little effect at first, and was poorer on limed than on unlimed ground.

Subsequently super plus potash, super, and slag were the best plots on limed ground, and slag and Ephos were best on unlimed ground. Super plus lime stimulated grasses as well as clovers.

Potash alone did not appear to have any effect, but the super-plus-potash plot on limed ground was very good. It is possible that the potash is having a slight effect. The remarks regarding the payable nature of manuring made on Experiment 5 also apply here.

7. FARM OF THE LATE A. W. ORME, ROBINSON'S BAY.

This experiment was laid down on country originally in bush. At the commencement of the trial the pasture was rather open; the main constituents were cocksfoot, rye-grass, dogstail, Yorkshire fog, sweet vernal, white clover, rib-grass, and catsear.

FIG. 14. EXPERIMENT ON FARM OF T. L. S. KAY, DUVAUCHELLE BAY (ONAWE).

Foreground, lime plus super; background, lime alone. The field had "got away" rather badly. Cows grazed the lime-plus-super plot very closely, the effect being visible from a great distance. Photo taken in January, 1928, six months after initial dressing of manures.

Responses to Lime and Manures.—The lime response was definite and greatly enhanced the responses from the phosphates. On limed ground super plus potash and super alone gave the best results the first season. Subsequently slag, Ephos, and basic super all gave good results, but super plus potash, super, and slag have been the best plots. On unlimed ground slag was superior to super in clover-growth after the first season. Potash alone was ineffective, but when used with super on limed ground the results indicate that potash has an effect.

Mr. Orme was a keen advocate of top-dressing, and had been proceeding with the practice gradually but systematically.

8. FARM OF T. MASEFIELD, AKAROA.

This experiment was laid down on a very dense sward of cocksfoot, rye-grass, dogstail, Yorkshire fog, sweet vernal, and white clover. The corner of the field selected had been used largely as a cattle camp and was in a state of high fertility. It was selected as being different from any other of the experiments, although not altogether typical of the field as a whole.

Responses to Lime and Manures.—The effects of treatments were never very definite in this area. Lime caused a slight improvement in clover-growth, and the phosphates caused slight clover responses at certain periods. Observation was made difficult because the area usually had much unconsumed herbage on it, chiefly due to the "camping" of stock in the past. The results were rather discouraging, although the phosphate plots on the unfenced portion, which was less affected by camping of stock, were slightly better grazed at times than the unmanured plots.

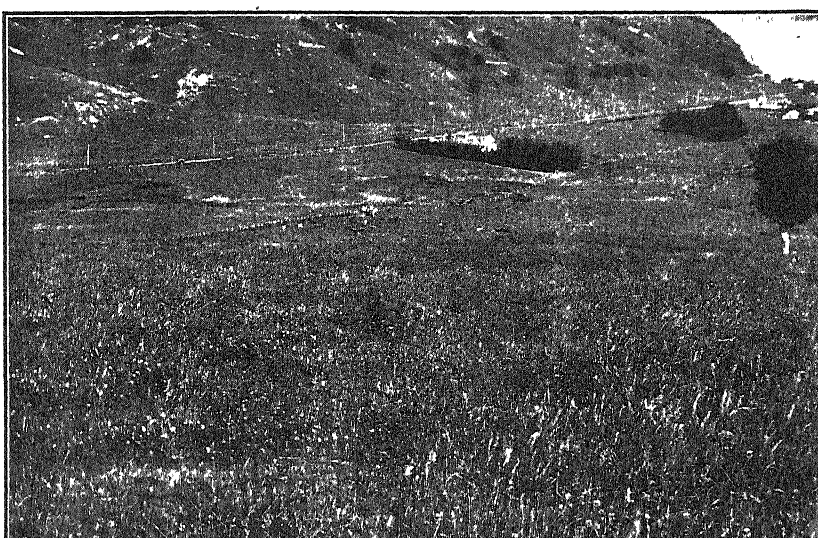


FIG. 15. EXPERIMENT ON FARM OF T. WAKELIN, DUVAUCHELLE BAY.

Left, super; right, no manure. Cows grazed the super plots much more closely. Sweet vernal and Yorkshire fog flower-heads were much in evidence on the no-manure plots. The strips were visible from the road, which can be seen in the background, at a distance of about half a mile Photo taken in January, 1928, six months after initial application of manures.

Mr. Masefield had used manures previously, but with indifferent results, although he considers that lambs fatten more readily on phosphated pastures.

9. FARM OF A. HELPS, AKAROA.

The area selected is at an elevation of about 1,000 ft. on a south-west face. The pasture was dogstail dominant, with cocksfoot, sweet vernal, danthonia, some rye-grass, white and suckling clovers, and flat weeds. As a result of haying the enclosed area cocksfoot became quite prominent.

Responses to Lime and Manures.—Lime caused an improvement, rye-grass and clover being more prominent than on unlimed ground. Subsequently slag, super, and Ephos gave the best results, especially on

limed ground. At certain stages after the first year Ephos appeared superior to super, while at other stages the reverse was the case. In the main, basic super was not as effective as the other phosphates, although all phosphate plots were better grazed than no-manure outside the enclosure. Potash appeared to be ineffective.

Mr. Helps is adopting top-dressing on parts of his farm.

10. FARM OF F. C. NEWTON, AKAROA.

This experiment is at a higher level than any of the others, being about 1,500 ft. on a sunny face of the hill. The sward is dominantly cocksfoot and white clover, with some rye-grass and fog, flat weeds, and suckling clover.

Responses to Lime and Manures.—The whole area, including the enclosure, was usually closely grazed when visited in the early stages, and responses were difficult to detect. Subsequently, however, considerable improvement was observed in the clover-growth on the limed plots. Of the manures super, super plus potash, and slag were the best, causing a fair increase in white clover and cocksfoot growth, especially on limed ground.

Summary and General Conclusions.

Responses to lime and phosphate have been observed on all ten experiments, the lime enhancing the responses from the phosphates in all cases, except in the early stage, when Ephos on limed ground was slower in effect than Ephos on unlimed ground.

Superphosphate showed the earliest effect on all experiments except Nos. 2 and 3; in these cases basic slag was more effective. Generally speaking, super on limed ground was markedly superior to super on unlimed ground. In a number of cases slag produced a better clover-growth after the first year than super, but super had more effect on grass-growth, especially on limed ground.

Basic slag gave good results in most cases, and appeared to be equal to super in the second year, and in two cases was superior to super in the first season (Experiments 2 and 3). With the exception of these two cases there seems to be little general difference between super and slag. Both gave better results on limed than on unlimed ground.

Basic superphosphate was responsible for improved growth, but was never superior to super or slag, and often was less effective.

Ephos gave as good results as super and slag in a few cases, but, generally speaking, was slower to act. In Experiment 2 Ephos was decidedly better than super in the first year.

Potash has been consistently ineffective when used alone. When added to super the mixture did appear to give slightly better results than super alone in two experiments.

The highest responses were obtained on the lower and relatively better-class country on which Experiments 4, 5, 6, and 7 were situated. The use of super and slag in conjunction with lime will undoubtedly pay well on such country, provided better utilization of the resultant growth is practised. On account of transport costs burnt lime would be the more economical form to apply (11 cwt. of burnt lime is equal to 1 ton of carbonate of lime, approximately). The farmer who cannot afford as much as ½ ton per acre of burnt lime should endeavour to apply 4 cwt. or 5 cwt. per acre, repeating the lime application every two or three years.

Superphosphate will be most rapid in effect, generally speaking, but the claims of slag are exceedingly good, and, in the absence of ability to apply lime, may be a better form of phosphate than super. In any case slag could well replace super after the initial dressing.

Dressings should be made in the autumn—at any time in March or April or when the autumn rains can be anticipated, rather than in the winter or spring. The autumn application will assist winter and early spring carrying-capacity without unduly increasing early summer production. Spring application tends to give its maximum effect in the early summer, when there is usually an abundance of feed and any additional grass is likely to accentuate the waste which so often occurs at this time.

The costs of transport should not be a deterrent. Even at the absurd figure of £5 per ton (the actual cost would be less than half of this) for cartage and application, we are convinced that—on the high-response land, at least—top-dressing would pay.

Unfortunately, a good many farmers adopt the practice of selecting particularly bad parts of their farms or pastures on which to begin improvement by top-dressing. The idea is to even up their pastures and do away with the "eye-sores." Much better financial returns will be obtained from application of manures to pastures which still have a reasonable sole of grasses and clovers. Broadly speaking, the practice should be to top-dress the better pastures first and apply the increased returns to the subsequent improvement of the poorer pasture. Manuring does not create grasses and clovers, but will materially assist the production of these when they are already present in the sward.

RE-ESTABLISHMENT OF PASTURE.

A good deal of country on easy slopes and ridge tops could be ploughed and resown. Although this is perhaps the last thing the average Peninsula farmer would consider, there is no doubt that with the abandonment of cocksfoot-seed production and the adoption of more intensive grazing it would pay handsomely to resow with good strains of perennial rye-grass and cocksfoot, including also such species as crested dogstail, white clover, and Poa trivialis.

PRECAUTIONS IN STORAGE OF CHLORATES.

THE fire risk attaching to the storage of chlorates should be realized by farmers and others using sodium or calcium chlorate for weed-killing purposes. These materials evolve oxygen when heated, thus very much increasing the intensity of a possible fire. Boxes and bags which have contained these materials are also liable to be highly inflammable owing to impregnation.

The State Fire Office advises that chlorates (and all other oxidizing materials) should be stored in bins, preferably of concrete or brick; zinc should not be used. Containers which have held these materials should not be stored, but destroyed as soon as empty. Care should be taken to keep chlorates well away from such substances as starch, sugar, gum, sulphur, fertilizers containing blood and bone, mineral acids, and dust. Care should also be taken to keep floors clean and free from spilled chlorates, as friction may cause ignition.

PHOSPHATE LOADING AT NAURU ISLAND.

THE NEW CANTILEVER INSTALLATION.

ALBERT F. ELLIS, C.M.G., New Zealand Commissioner, British Phosphate Commission.

THE phosphate-shipping operations at Nauru probably constitute the most difficult problem to be dealt with there, being attended, as they are, with the necessity of laying deep-sea moorings for the vessels in about 200 fathoms (1,200 ft.) of water. This is owing to the fact that Nauru is practically a mountain with its top above sea-level. The sides descend at an angle of 45 degrees, consequently a vessel's anchors and chains are useless to her safety, as even when lowered they could not keep her from coming in on the reef. Moreover, the island is so small and isolated that there is no protection from the sea and swell of the open ocean, except when the wind blows off shore.

The only method of shipping phosphate at Nauru has hitherto been by lightering. A number of surf boats are used, carrying the phosphate in large baskets which are hove up by the vessel's winches and returned for refilling. Launches tow the lighters to and from the jetty to the vessel Under ordinary good weather conditions the work goes well, as much as 2,000 tons in a day of two shifts being frequently shipped. This system is, however, a great strain on the organization, by reason of the large number of boatmen, launches, lighters, &c., employed ; a considerable quantity of phosphate also is lost in shipment ; and, moreover, the system does not permit of sufficiently fast shipping when really suitable weather is experienced.

In order to overcome these difficulties a system of mechanical loading has been installed by means of a cantilever with two swinging arms supporting rubber belt conveyors. The object of the double end is to enable a vessel when moored in position to take in cargo both in the forward and after holds, thus not requiring to shift her position until loaded.

Preparatory to shipment the phosphate is stored in the shore bin, having a capacity of 12,000 tons, and is removed from there by means of a rubber belt conveyor running in a tunnel the full length of the bin, thence up an inclined gallery, discharging its load of 500 tons per hour at the compensating hopper half-way along the cantilever. At this point the stream of phosphate is divided, and passes in galleries along the two swinging arms by two smaller conveyors. At the extreme end of each arm of the cantilever an extension boom can be run out, giving a further overhang. The conveyors discharge their load at the outer end of this extension boom, and the phosphate drops by a telescopic chute direct into the vessel's holds.

The entire plant is operated electrically. and is controlled from a small cabin at the end of each arm. An operator sitting there can swing the arm out over the vessel as soon as she is moored in position ; other controls run out the extension boom, set the conveyors in motion, and open the doors of the compensating hopper ; the phosphate then streams along to the vessel at the rate of 500 tons per hour. With

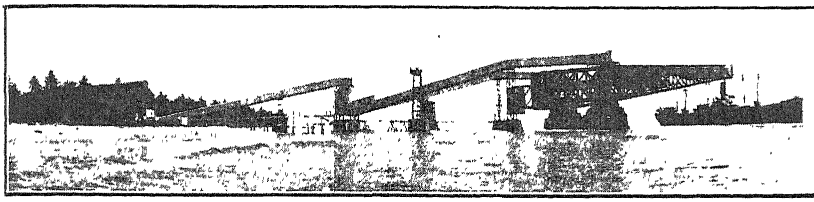


FIG. I. PANORAMIC VIEW OF THE NAURU CANTILEVER, LOOKING SOUTH.

The 12,000-ton dry storage-bin is seen on left of picture " Nauru Chief " in loading position at end of cantilever.

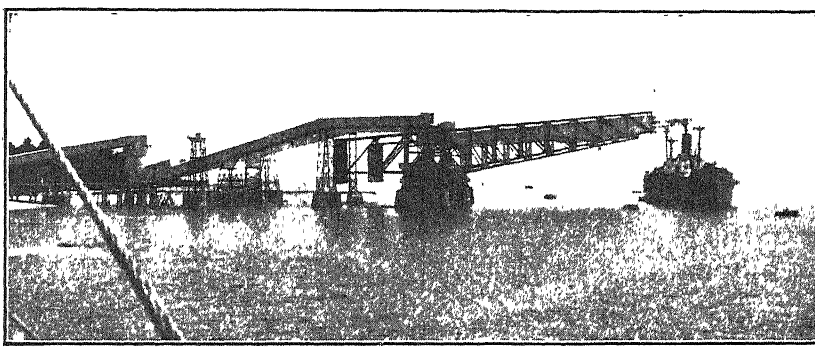


FIG. 2. " NAURU CHIEF " UNDER CANTILEVER LOADING PHOSPHATE INTO NO. 2 AND NO. 4 HOLDS.

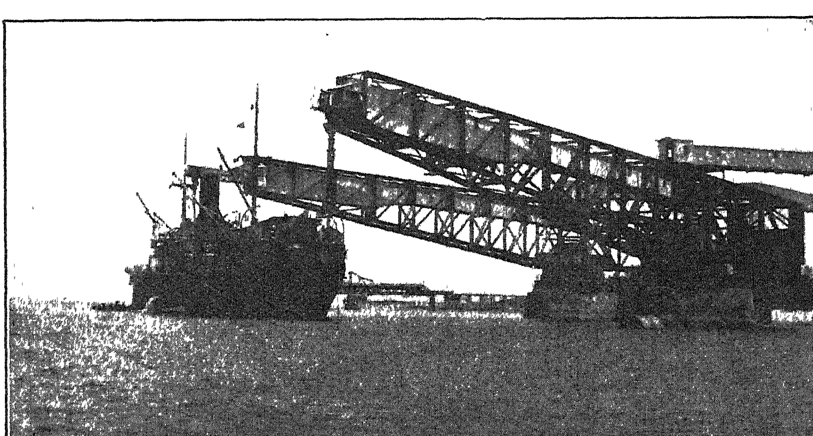


FIG. 3. VIEW OF CANTILEVER ARMS, LOOKING NORTH-EAST.

Showing north crane in loading position, and south crane being swung out over the " Nauru Chief." No. 2 jetty seen in distance.

this facility of control, loading can be stopped instantly, the extension boom run back, the arms swung round towards the shore, and the vessel left clear for putting to sea in a very few minutes.

The construction of the cantilever, which was supplied and erected by Messrs Henry Simon, Ltd., of Manchester, England, occupied nearly three years. It was finished in October, and the system of moorings was also completed then. A few days later, fine weather permitted of a trial being held. The Commission's steamer "Nauru Chief," which had just completed the mooring work, was hove into position and there loaded all the phosphate she was able to take. The trial passed off very satisfactorily, and there is every reason to think the installation will prove successful for loading steamers of up to 7,000 tons capacity.

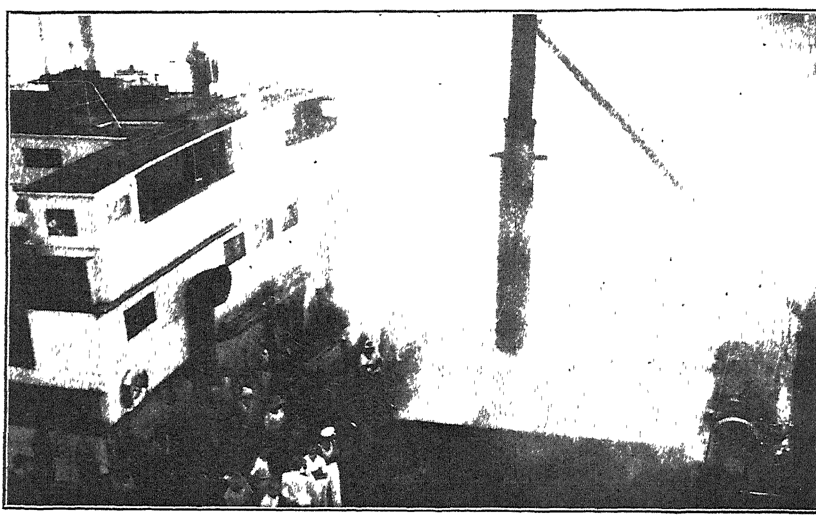


FIG. 4. THE FIRST PHOSPHATE LOADED DIRECT INTO SHIP'S HOLD AT NAURU.
Showing the telescopic chute of the north crane discharging into No. 2 hold of the "Nauru Chief."

It is obvious, however, that to moor a large steamer so close to the reef in unprotected waters entails a certain degree of risk, thus making it entirely a fine weather system of loading. Under suitable weather conditions the installation should be a labour-saving and expeditious method of doing the work.

In order to keep the cantilever fully supplied with ample stocks of phosphate ready for shipment, it will be necessary to further increase the crushing and artificial drying plant, the bin storage accommodation, railway-line extensions, &c. This will be done in due course, and these developments, together with others recently completed at Nauru and Ocean Islands, will place the industry in a much stronger position for meeting the phosphate requirements of New Zealand and Australia.

FARMERS' FIELD COMPETITIONS.

TARANAKI, WELLINGTON, AND HAWKE'S BAY DISTRICTS, SEASON 1929-30.

R. P CONNELL, Fields Division, Department of Agriculture, Palmerston North.

IN the Taranaki, Wellington, and Hawke's Bay Provinces farmers' field competitions were conducted last season on the same general lines as have been followed for some years. That the competitions continue to be popular in these districts, where their value has been most thoroughly tested, is indicated by the total number of entries judged during recent years: 1926-27, 268; 1927-28, 370; 1928-29, 503; 1929-30, 523. The entries judged in the different districts were as follows, last year's figures being given in parentheses: North Taranaki, 327 (345); South Taranaki, 143 (96); Wanganui, 32 (20); Feilding, 11 (15); Hawke's Bay, 6 (13); Wairarapa, 4 (14).

In certain districts there has been a slight falling-off in the number of entries judged, but in most of these districts the support accorded the competitions recently has been so meagre as to reduce their instructional value. The value of such competitions depends to a considerable degree on the number of entries which are compared during the course of the competition; generally if only a small number of entries are considered the conclusions which may be drawn from a comparison of different methods and results are relatively few and unreliable. This means that such competitions are of distinctly limited value unless they are fairly freely supported, and this may be taken as the reason for the decline that took place last season in certain districts.

One valuable instructive effect of the competitions, even in districts where relatively few entries have had to be considered, lies in the fact that they have provided evidence of the possibility of obtaining highly satisfactory crop-yields by the adoption of suitable management. For instance, although only three crops were judged in the mangel competition in Hawke's Bay, the winning crop, which was grown on land generally typical of large areas in the southern part of the province, and which yielded 55 tons per acre, provides definite evidence that under suitable management profitable mangel crops can be grown under those conditions. Likewise, although only four swede crops were judged in the Wairarapa competition, the fact that the winning crop was one of 60 tons per acre is significant.

The most striking current feature of the competitions has been the growth in popularity of the ensilage competitions, which so far have been confined to Taranaki. The numbers of entries judged during the past four seasons have been as follows: 1926-27, 37; 1927-28, 67; 1928-29, 130; 1929-30, 191.

It is probably indicative of the trend of farm-management in Taranaki to find that as the number of entries in the ensilage competitions increases the number of entries in the special forage-crop competitions tend to decrease. The fact that the entries in the root-crop competitions in Taranaki are falling-off somewhat is not to be taken as showing that Taranaki farmers are becoming less appreciative of the

value of farmers' field competitions; it means merely that modifications in their farm practice have led them to direct their energies along different lines with a similar objective—that is, provision of feed to supplement pastures during critical periods.

MANGELS.

Eighty-six crops of mangels, of an average yield of 58 tons 12 cwt. per acre, were judged in the 1929–30 season, as compared with ninety-two crops of an average yield of 59 tons 14 cwt. in the previous season. The slight falling-off in yield may reasonably be attributed to the relatively unfavourable weather conditions in the 1929–30 season. The results of the various districts are summarized in the following table:—

Table 1.—Summary of Mangel Crops.

District.	Number of Entries judged	Yield per Acre.	
		Tons	cwt.
North Taranaki ..	31	55	15
South Taranaki ..	24	63	19
Wanganui	18	60	12
Feilding ..	7	52	14
Southern Hawke's Bay ..	3	49	13

The heaviest crop grown was that of Mr. J. Reid, Toko, which yielded 119 tons 4 cwt. per acre, and won the Sutton Cup for North Taranaki for 1929–30. Of this crop Mr. J. M. Smith, of the Fields Division, New Plymouth, writes: "The whole of the drainage, &c., from Mr. Reid's cow-shed soaked down through the crop, and no doubt was a big factor in the yield. The land was ploughed in July, then worked down with the disks and harrows, and Prizewinner seed sown on 2nd October at the rate of 6 lb. an acre, in 18 in. drills. The manure used was 4 cwt. superphosphate, 3 cwt. blood-and-bone, 3 cwt. kainit, and 3 cwt. nitrate of soda."

In South Taranaki the Sutton Cup was again won by Mr. H. Betts, sen., with a crop of 101 tons 9 cwt. per acre. Mr. Betts sowed on 12th October 5 lb. per acre of Prizewinner seed in drills 18 in. apart, and applied 6 cwt. of manure per acre.

In the Wanganui district the competition winner was Mr. L. Crawley, with a crop of the Prizewinner variety yielding 81 tons per acre. In the Feilding district Mr. A. J. Baxter won with a Prizewinner crop yielding 64 tons 7 cwt. per acre, which was sown on 28th October, the seeding being 6 lb. per acre in 26 in. drills, and 8 cwt. per acre of fertilizer was applied. In Southern Hawke's Bay Mr. W. J. Sedcole won with a crop of Prizewinner which yielded 55 tons per acre, and which received 7 cwt. per acre of high-grade fertilizer.

The mangel competitions disclose the following further interesting facts:—

(1) In all districts the winning crop was the Prizewinner Yellow Globe variety; 75 per cent. of the crops of which records were obtained were Prizewinner.

(2) The average manurial dressing applied to the crops recorded was slightly over 5½ cwt. per acre, exclusive of dressings of salt; the dressing ranged from 13 cwt. to 3 cwt. per acre; two crops received 13 cwt. of fertilizer per acre, and their average yield was 107 tons 9 cwt.

(3) The great majority of the high-yielding crops received a fertilizer dressing of 5 cwt. or more per acre.

(4) In a number of instances crops which received a manurial dressing greater than the average were below the average in yield—evidence that liberal manuring of itself will not ensure good yields.

(5) In slightly less than half the number of crops recorded the fertilizers used were proprietary mixtures. The growers of the winning crops did not use proprietary mixtures.

(6) In the instances in which proprietary mixtures were not used, superphosphate, blood-and-bone, and basic slag were prominent in the dressings used.

(7) The two crops which in the 1929–30 season yielded over 100 tons an acre were sown in drills 18 in. apart; crops ranging in yield from 76 tons to 97 tons per acre were sown in drills 28 in. apart; many excellent crops were grown in drills 20 in. to 26 in. apart.

(8) The amount of seed used ranged from 3½ lb. to 8 lb. per acre, and the use of both these amounts resulted in crops much above the average; 5 lb. to 6 lb. of seed was most generally used.

(9) More mangel crops followed grass than any other crop. It is significant, however, that the highest crop of the season resulted from mangels following mangels, and that a substantial number of other good crops were obtained in this manner.

(10) In the majority of instances the preparatory cultivation was commenced between the middle of August and the middle of October; this was true when the mangels followed grass as well as when it followed another annual crop.

CARROTS.

In general, good yields were obtained in the case of the carrot crops, fifty-two crops averaging 42 tons 7 cwt. per acre, as compared with thirty-nine crops averaging 41 tons 7 cwt. in the previous season. The results in the various districts are summarized in the following table:—

Table 2.—Summary of Carrot Crops.

District.	Number of Entries judged.	Yield per Acre.	
		Tons	cwt.
North Taranaki ..	14	39	19
South Taranaki ..	23	47	12
Wanganui	14	37	11
Feilding .. .	1	22	10

The heaviest crop in the carrot competitions was that of Mr. H. Hoskins, Matapu, South Taranaki, which yielded 66 tons 4 cwt. per acre, and which resulted from sowing 1¼ lb. of Barriball variety

in 14 in. drills on 22nd October, on land which was in mangels the previous season, which was ploughed in October, and which received 3 cwt. per acre of fertilizer.

The winning crop in North Taranaki—that of Mr. N. Berridge, Omata—yielded 62 tons 12 cwt. This was of the Guerande variety, and was sown on 20th November in 14 in. drills on land which was top-dressed with slag before sowing, and which received 3 cwt. of fertilizer at sowing.

In the Wanganui district the first place was taken by Messrs. Murray Bros., Brunswick, with a 61 tons 17 cwt. crop.

The carrot competitions disclose the following further facts :—

(1) The most popular variety is Matchless White, which is characterized by high average yield; Barriball, Guerande, and White Belgian all have been grown freely and have yielded well.

(2) The average manurial dressing applied to the crops recorded was $4\frac{1}{2}$ cwt. per acre; the dressing ranged from 3 cwt. to 7 cwt.; there was one instance in which no fertilizer was applied to land which had grown mangels in the previous season.

(3) Some of the most heavily manured crops were not prominent in respect to yield, and *vice versa*.

(4) With the great majority of the crops recorded special proprietary fertilizer mixtures were used; when proprietary manures were not used a mixture of superphosphate and bonedust was almost always employed, and was productive of many good yields.

(5) The amount of seed ranged from 1 lb. to 4 lb. per acre; the seeding usually adopted was from 1 lb. to $1\frac{1}{2}$ lb., and this gave many exceptionally good yields.

(6) Almost invariably the crops were sown in drills 14 in. apart, but really good yields were obtained with crops sown in rows from 16 in. to 28 in. apart.

(7) Carrots frequently followed grass with success, but with equal success they followed other annual crops, including carrots.

(8) Preparatory cultivation was most generally commenced between mid-August and mid-October.

Swedes.

There was a decided falling-off in the number, but an increase in the yield of the swede crops which were judged—sixty-nine crops averaging 44 tons 17 cwt. per acre, as compared with 120 crops averaging 38 tons 14 cwt. for the previous season. The results of the different districts are given in the following table :—

Table 3.—Summary of Swede Crops.

District.	Number of Entries judged.	Yield per Acre.	
		Tons	cwt.
North Taranaki ..	47	46	10
South Taranaki .	15	41	0
Feilding	3	28	15
Wairarapa	4	51	8

The heaviest crop in the swede competitions and the winner of the Polson Cup was that of Mr. H. Wells, Pukearuhe, North Taranaki, which yielded 71 tons 4 cwt. This crop was of the Superlative variety, and was sown in 14 in. drills at the rate of 12 oz. seed per acre. It was sown just before Christmas on land which produced swedes the previous season, and it received 3 cwt. of fertilizer.

The winning crop in South Taranaki—that of Mr. G. Alexander, Matipu—yielded 52 tons 1 cwt. per acre, and resulted from the sowing on 15th December 12 oz. of Grandmaster seed in 7 in. drills, with an application of 4 cwt. of fertilizer per acre, on land which was previously in grass and which was ploughed on 20th November.

In the Feilding district Mr. W. H. Booth, of Cheltenham, won with a 38 tons 8 cwt. per acre crop of Masterpiece variety, sown on 20th December in 14 in. drills, at the rate of 12 oz. seed per acre, on land which had grown mangels the previous season and which received 4 cwt. of fertilizer per acre.

In the Wairarapa Mr. M. J. Wilton, of Mount Bruce, won the Sutton Cup with a 60 tons 12 cwt. per acre crop of the Superlative variety, which was sown at the rate of 16 oz. seed per acre on 13th December, in 7 in. drills on land which was ploughed out of grass in July and which received 2 cwt. of fertilizer.

The swede competitions disclose the following further facts :—

(1) In South Taranaki nearly all the recorded crops were of the Grandmaster variety, but Superlative, Masterpiece, and Magnum Bonum were also grown ; in other districts Superlative, Masterpiece, and Grandmaster shared popular favour almost equally, while Vilmorins and Magnum Bonum also received fair attention.

(2) The amount of manure used ranged from 2 cwt. to 7 cwt. per acre, and averaged $3\frac{1}{2}$ cwt. The manures used were extremely variable in composition, and the only common feature is that phosphates were the dominant constituent. Apart from proprietary mixtures, a dressing consisting of about two parts of superphosphate to one of bone manure was most generally used, and gave good results.

(3) Almost invariably swedes were sown in land ploughed out of grass—quite a sound practice, in view of the incidence of such diseases as club-root and dry-rot. In a few instances swedes followed swedes, and generally the resulting crops were relatively low in yield.

(4) The amount of seed used ranged from 9 oz. to 24 oz., both of which quantities gave really good crops. The practice most generally adopted was the sowing of 12 oz. to 16 oz. of seed in rows 14 in. apart, and a high proportion of the outstanding yields resulted from this method.

CHOU MOELLIER.

[illegible]n North Taranaki two crops of chou moellier were judged. The w[illegible]ng crop — that of Mr. J. L. Corlett, Ratapiko — weighed 3[illegible]s 11 cwt. Last season Mr. Corlett was also the winner, with [illegible]p weighing 48 tons 13 cwt. In South Taranaki four crops were judged, and the winning one—that of Mr. A. A. Piper, Lowgarth—weighed 25 tons.

Soft Turnips.

The only competition for soft turnips was conducted in South Taranaki, where eight crops were judged, the winning one—that of Mr. A. T. Burke, Lowgarth—weighing 45 tons 16 cwt.

Lucerne.

In South Taranaki Mr. W. J. Hollis won the "old stand" competition, in which there were nine entries.

Potatoes.

The only potato competition, which was in Southern Hawke's Bay, attracted three entries, and was won by Mr. G. R. Kells, Norsewood, with a 21 tons 4 cwt. crop of Sutton's Supreme, which received 10 cwt. per acre of a fertilizer containing superphosphate, sulphate of ammonia, and sulphate of potash.

Ensilage.

In North Taranaki there were four classes for ensilage in the season under review. These were (1) stacks, (2) hillside stacks, (3) earth pits, (4) concreted pits. A hillside stack is a stack let into the ground on a hillside, having one or more sides against a bank but not being completely enclosed.

Stacks.—Mr. A. Turnbull, Huirangi, with a total of 94½ points out of 100, won the Fertilizer Company's Cup for stack ensilage, out of 105 entries. Mr. J. M. Smith, of the Fields Division, writes: "The outstanding feature of the winning stack was the way in which waste had been reduced to a minimum. One of the great drawbacks to the stack method of making ensilage is the waste that occurs, and every endeavour should be made during saving and building to have this as small as possible. In Mr. Turnbull's stack the waste was only about 4 in. on all sides. The quality of the raw material and the way it had been conserved were also strong features, and the points gained under these headings were 58 out of 60. The pasture the winning stack was made from was ten years old, and had been sown down with a good mixture which included a good perennial rye. The pasture had been well looked after, and the top-dressing during the past season was with 1½ cwt. basic super, 1½ cwt. rock phosphate, and 1 cwt. 30 per cent. potash. The crop was cut on 12th December, while the herbage was in a young growing condition. The size of the stack was 21 ft. square. The material came in straight from the mower, and the stack was built to a height of 8 ft. the first day. Building was continued and completed the following day, when the stack went to the height of 15 ft., and 15 in. of soil was put on straight away Planks on edge were used to hold the soil, and a very good job was made of the topping. The material went in very wet, and it was actually raining part of the time during cutting."

That the competitions are proving instructive is indicated by a report from Mr. J. M. Smith, as under:—

"The following points were noticeably brought out during the past season in connection with stack ensilage:—

"(1) The crops should be cut at an earlier stage than has been the case in the past. The season saw an improvement in this respect, but

there is still room for further improvement generally speaking. Almost without exception the stacks gaining high points for quality were those cut early.

"(2) The quality of the raw material is a big factor in the quality of the resultant ensilage, and many competitors who conserved their material in splendid condition lost points on account of the poor quality of the grasses.

"(3) That rain does not greatly interfere with the quality of the ensilage made was evident from the fact that many of the stacks gaining high points were actually saved in the rain.

"(4) The sooner the material can be put into the stack after it is cut the better.

"(5) Care in building—keeping the walls upright and the centre slightly high—is reflected in the resultant amount of waste. The centre of the finished stack should not be too high, however, otherwise trouble will be experienced in getting the soil to hold in the top. Likewise the walls should have plenty of height in them and should not be rounded off. A flat ledge round the edge of the stack for holding the soil is a good idea.

"(6) There is no necessity to miss a day between buildings. Where hand-pitching is being done; however, the missing of a day may be an advantage in order to get the benefit of the subsidence.

"(7) In the past there appears to have been a tendency to allow the temperature to get too high. Slightly over 100° F. appears to be high enough, although there is a big range of temperature under which good ensilage can be made. One stack in which the temperature reached 140° turned out just as good as that where the temperature was 105°.

"(8) At least 1 ft. of soil should be put on, and this should be brought well out on to the sides. Where rakings are put on top just under the soil it is inevitable that a dark ensilage will result.

"(9) One of the best methods of holding the soil well out is to use wire netting, but other methods are just as successful if carefully done.

"(10) Open the stack in such a fashion that about 6 in. to 8 in. is removed daily. If the herd is large and the stack small the whole top may be uncovered and the stack fed from all over, but otherwise it will pay to take a section right down to the ground."

Hillside Stacks.—The class of twenty entries for hillside stacks was won by Mr. W. W. Thorby, Kaimata, who also won Blyde Bros.' Cup with a total of 94 points. The material of this stack was cut on 18th December from four-year-old pasture. Building was carried on continuously from the cutting of the material. Twelve inches of soil was put on the stack as soon as it was completed, and was held in position by sacks.

Earth Pits.—There were sixteen entries in the class for earth pits, and the winner was Mr. A. J. Hall, Hillsborough, with 94 points. The cutting of the material, which was from ten-year-old pasture, was commenced on 6th December, and material to a depth of 14 ft. was put in the pit the first day. Three days were missed, and then another 8 ft. added, and three days later a further 8 ft. was put in. The pit was 15 ft. in diameter and 14 ft. in depth, with perpendicular walls, and it was fitted with a wood and iron roof.

Concrete Pits.—In the class for concrete pits six entries were judged, and the winner was Mr. P. A. Openshaw, Lepperton, with 96 points. The material was cut in November from twenty-year-old pasture in which rye-grass was dominant. The pit was filled to a depth of 10 ft. the first day, and subsequent additions of material were made at intervals of a day and a half, while two days elapsed between the final addition of green material and the putting-on of the soil covering. The pit was 18 ft. in diameter and 20 ft. deep.

This competition brought out the following points:—

(1) In the pit method waste of material by decay is practically eliminated and labour costs are reduced.

(2) The temperature of the material rises more slowly in pits than in stacks; hence with pits longer intervals between successive additions of green material are necessary.

(3) Whether the walls are slightly sloping or perpendicular is of little importance, but more waste occurred on the average with sloping walls.

(4) In feeding from pits, in order to avoid unnecessary waste, material should be removed from the whole top surface at the one time.

In South Taranaki two ensilage competitions were conducted. In the stack class of thirty entries the winner was Mr. N. W. Scown, Otakeho, and in the pit class of fourteen entries Mr. T. Harworth, of Auroa, came first.

HAY COMPETITION.

In North Taranaki the winners of a class of fifty-four entries was Messrs. J. F. Phillips and Sons, Urenui, who obtained 94 points, and who take the Daily News Cup. In South Taranaki a class of fifteen entries was won by Mr. H. Ward, Tokaroa, with 89 points.

RUAKURA FARM TRAINING COLLEGE.

THE growing popularity of the practical course in farming available for lads at the Ruakura Farm Training College is evidenced by the fact that the Department has not been able to accept a number of applications received for the first term of 1931, owing to all available vacancies having been filled. Already several applications for entrance to the College in June, 1931, have been accepted, and parents wishing their sons to commence at Ruakura for the second term are advised to submit applications at the earliest possible date.—*Fields Division.*

Dealing with Second-growth Country.—The annual report of the Fields Division for 1929–30 makes the following reference to this subject: "Experimental work on hill country (particularly in Whangamomona County) reverting to secondary growth has been continued, and the excellent results secured are being made use of over a wide area of country wherein the conditions are similar to those existing there. The demonstration farm conducted in Whangamomona County under the provisions of the Deteriorated Lands Act has been carried on throughout the year, and notwithstanding that it is being run partly on experimental lines the good work done by those responsible on the place has resulted in quite excellent returns being shown. The instructional officers of this Division continue to co-operate with the officers of the Lands Department in the work necessitated in connection with advances under the Deteriorated Lands Act, particularly in the back country of Taranaki and the King-country, and great improvement is shown. This is brought about chiefly by the use of fertilizers and by subdivision There are still 871 farms under supervision."

WINTON EXPERIMENTAL FARM.

RECORD OF WORK FOR SEASON 1929–30.

R. B. TENNENT, Fields Superintendent, Department of Agriculture, Dunedin

DURING the season of 1929–30 the Winton Experimental and Demonstration Farm was mainly devoted to a furtherance of the pasture-work previously laid down with the object of ascertaining the value of various species of grasses and clovers, and the effect of intensive manuring under a rotational-grazing system of management. The general trend towards adoption of the more intensive type of grassland farming has of recent years called for quite extensive researches into its many phases, and the Management Committee is to be commended for its initiative in utilizing the farm for this purpose, thus assisting Southland farmers to determine the efficacy or otherwise of the system. Other grassland problems investigated during the season included the establishment of pastures, their maintenance, and utilization methods aimed at a more economical conversion of the pasture into various animal products.

In continuance of the policy laid down by the Committee of gradually establishing a dairy-herd on the farm, the small herd of ten cows was increased to twenty-six by the end of the milking season. Several pedigree milking Red Poll cattle were also purchased from the Weraroa Experimental Farm, together with a pedigree Friesian bull to head the grade herd. A three-cow milking plant electrically driven was also installed. The herd was entered for testing under the Southland Herd-testing Association. Further, a line of high-grade Friesian heifer calves were purchased and reared on the farm. The planting of shelter-belts, so necessary on a farm of this kind, was carried out.

ROTATIONAL GRAZING INVESTIGATION.

In September, 1928, an area of 20 acres, comprising Blocks 2, 4, 6, and 8, was subdivided in such a way as to give eight fields, each of 2½ acres in extent, an adequate water-supply being provided for each field. These fields during previous years had been treated with various phosphatic and potassic manures, together with carbonate of lime and burnt lime. The plant association also differed widely, including fields of both high and low quality of pasture. (See plan on page 410.)

With the introduction of the intensive rotational-grazing trial it was decided to simplify the manurial programme by treating the whole area with 44–46 per cent. superphosphate, applied during the month of September, 1928, at the rate of 2 cwt. per acre. By November of that year it was quite evident that the small herd of ten cows was otally inadequate to effectively control the grazing on this 20 acres. our fields, each of 2½ acres in extent, were therefore closed to stock d cut for hay during early January, 1929. The remaining four fields e grazed as bare as was practicable, then mown, and closed up ecover.

During this period the weather was entirely favourable for pasture-growth, and the fields recovered sufficiently to give a further grazing in from seventeen to twenty-four days. Four of the fields were then temporarily fenced into 1¼-acre blocks in order to suit the permanent

watering system, with the object of more efficiently controlling the pasture-growth. Up to the end of March this 10 acres was found to carry the ten cows above mentioned. The autumn experience thus gained proved of great practical value in deciding the stocking-capacity for the spring of 1929.

The manurial programme adopted for the various fields is summarized as follows :—

(1) All fields comprised in the 20 acres received a dressing of 44–46 per cent. superphosphate during April, 1929, and again in January, 1930, at the rate of 2 cwt. per acre.

(2) In addition 1 cwt. per acre of sulphate of ammonia was given to the following fields on the dates specified :—

Field.	First Dressing	Second Dressing.	Third Dressing.
2A	4/7/29	11/10/29	28/3/30
4B .. .	18/7/29	15/10/30	29/3/30
6A	3/8/29	21/10/29	25/3/30
8B	15/8/29	22/10/29	24/3/30

The system of grazing followed closely along lines laid down as ideal for the control of pastures by the milking-herd or first-line production stock Grazing returns from each field were accurately recorded, this allowing for an investigation into the merits or otherwise of highly soluble nitrogenous fertilizer when used to promote "out of season" grass. Each field was adequately harrowed when occasion showed the necessity for so doing.

As could be expected, the response from sulphate of ammonia varied considerably, and was apparently very largely dependent on the age and composition of the pasture to which it was applied Generally speaking, from seven to ten weeks' time was required to produce a good dense growth of grass, 5 in. to 6 in. in height, from the July application. On young pastures in Southland this result is usually obtained in about five to seven weeks, while for old pastures in poor condition anything up to twelve weeks' growth is required. Several of the earlier-treated fields were ready for grazing before the majority of the herd came into profit ; hence the grazing of those fields was somewhat curtailed, necessitating lengthy periods of grazing to cope with the extra growth. It is to be recorded that the value of sulphate of ammonia was evinced by its producing herbage from two to three weeks earlier than on those fields not top-dressed with this fertilizer. The grass-stimulation was particularly noticeable with perennial rye-grass and meadow foxtail, and cocksfoot was also much improved. With regard to white-clover growth, an improvement was apparent during the earlier part of the season, but by late December this superiority had largely disappeared ; in fact, the fields treated with sulphate of ammonia showed quite an apparent diminution of white clover.

After the first grazing by the dairy herd and the followers, which comprised a line of 200 good-conditioned wethers, each field was again harrowed and received a further dressing of sulphate of ammonia at the rate of 1 cwt. per acre, being then closed to stock. The spring growth proved particularly good on all but one field, with the result that the

whole herd of twenty-six cows was carried on the 20 acres until the end of December, 1929, with one exception. This occurred through several of the fields being grazed too hard and bare by the wethers, so that recovery of those fields was prolonged, thus necessitating the use of one other field of 2 acres as a night paddock for thirteen nights, from 23rd November to 5th December.

RESULTS OF TRIAL.

The following tabulation gives the comparative figures for grazing-days and butterfat-production for the various fields under trial.

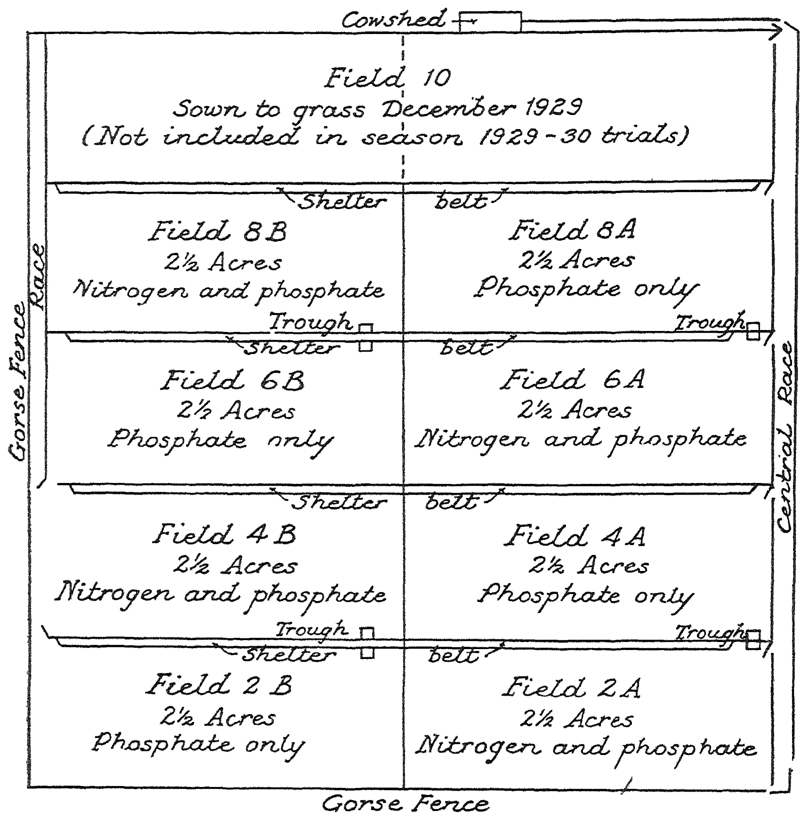
Table 1.—Results of Rotational Grazing Trial, 1st July, 1929, to 30th June, 1930.

Field No.	Treatment.	Cow Days per Acre.	Butterfat per Acre.	Dry-stock Days per Acre.
2A ..	Nitrogen and phosphate ..	243·3	243·3	67·4
2B ..	Phosphate only ..	206·4	212·7	54·4
	Difference in favour of nitrogen ..	36·9	30·6	13·0
4B ..	Nitrogen and phosphate ..	287·1	276·0	93·7
4A ..	Phosphate only ..	277·2	271·7	63·0
	Difference in favour of nitrogen ..	9·9	4·3	30·7
6A ..	Nitrogen and phosphate ..	226·9	221·6	49·2
6B ..	Phosphate only .	125·5	121·5	77·3
	Difference in favour of nitrogen ..	101·4	100·1	−28·1
8B ..	Nitrogen and phosphate ..	195·3	211·2	87·9
8A ..	Phosphate only ..	238·8	239·7	35·9
	Difference in favour of nitrogen ..	−43·5	−28·5	..
	Average differences in favour of nitrogen	26·2	26·6	16·9

NOTE.—" Cow days per acre " = number of cows grazed × number of days ÷ acres. " Dry-stock days " are similarly calculated. Stock other than dry cows are calculated as a fraction of a dry cow, according to type and age.

While the general results from the whole 20 acres under trial were more or less what one expected as a result of using sulphate of ammonia, an examination of individual pairs of fields show in some cases disappointing results. Broadly speaking, what might be termed the best pastures have given the poorest response to sulphate of ammonia, and, conversely, the poorest fields have given the most payable returns. This is clearly shown by the comparison of Fields 4 and 6. Field 4 is the best pasture on the farm, and gave the highest butterfat per-acre return, 276 lb. being produced from that half receiving nitrogen and phosphate, and 271·7 lb. from that half dressed with phosphate alone. The increase due to nitrogen, however, is only 4·3 lb. per acre. When this result is contrasted with that obtained from Field 6, which undoubtedly is a poor pasture, requiring renewal, it can at once be noted that here sulphate of ammonia has given a very definite increase in butterfat-production. That Field 6 is a poor producer will be noted

from the fact that the half dressed with phosphate yielded only 121·5 lb. of butterfat per acre, as against a yield of 271·7 lb. from the similarly treated half of Field 4. With the application of nitrogen, however, a high percentage increase occurred on Field 6, the half treated with nitrogen and phosphate returning 221·6 lb. of butterfat, an increase of 100·1 lb. over the half field treated with phosphate alone.



PLAN OF ROTATIONAL GRAZING TRIAL AT WINTON EXPERIMENTAL FARM, SEASON 1929–30.

This result is contrary to what one would expect, as it has always been assumed that payable responses from sulphate of ammonia could only be looked for by applying this fertilizer to high-producing pastures. It must, however, be admitted that the superiority of nitrogen response on the poor Field 6 over the response on the good Field 4 seems to be quite anomalous. Consideration of the dry-stock days would indicate that better utilization with milking-cows on the phosphate-alone half of Field 4 has been carried out than on the nitrogen half on which the growth had to be cleaned up with dry stock. With Field 6, however,

the reverse is the case. The results in total stock days (cow days plus dry-stock days) for each field are therefore as follows:—

	Field 4. Stock Days.	Field 6. Stock Days.
Phosphate and nitrogen	380·8	276·1
Phosphate only	340·2	202·8
Difference in favour of nitrogen	40·6	73·3

The nitrogen effect is still shown to be greater on the poorer pasture of Field 6. This field was practically devoid of clover, and, as the writer's experience in the South has repeatedly shown that phosphate responses are largely represented by increases in clover-growth, it will be realized that the absence of clover in Field 6 gave the nitrogen field a decided advantage over the phosphate field. In the case of the nitrogen half of Field 8 also it is evident that full advantage has not been taken of the grass by the use of milking-cows, and that the pasture has required more dry stock as followers to clean it up than is the case with the phosphate half. The total stock days (cow days plus dry-stock days) are as follows: Phosphate plus nitrogen, 283·2; phosphate only, 274·7: difference in favour of nitrogen, 8·5.

It must be borne in mind, however, that the grazing was conducted in an exceptionally good manner throughout the trials, being in all probability much more effectively done by the farm staff than would be the case with the average farmer. If the success of rotational grazing and intensive manuring with phosphates and nitrogen is dependent on extremely refined methods of grazing, then its practical application on farms will undoubtedly meet with many failures.

Ignoring individual records from various pairs of fields, and taking the average production over the whole 20 acres under trial, it will be observed that those fields treated with sulphate of ammonia and phosphate gave an increase over the fields treated with phosphate alone of 26·2 cow days per acre, and a butterfat increase of 26·6 lb. per acre. In addition to this an increase of 16·9 dry-stock days per acre has to be credited to the use of sulphate of ammonia.

It is interesting at this stage to attempt a comparatively simple costing examination of the two sets of fields, with a view to ascertaining whether the application of sulphate of ammonia was profitable in use. For the purpose of this examination butterfat has been valued at 1s. 4d. per pound (the approximate value for the 1929–30 season), dry-stock grazing at 3d. per day, and sulphate of ammonia at 12s. 6d. per hundredweight. No consideration has been taken of the cost of railage and cartage of the fertilizers to the farm, nor the expenditure involved in time and labour in applying them to the various fields. On this basis the results are as shown in Table 2 (next page).

From this table it will be observed that in the case of Field 2 a small profit of 6s. 7d. per acre was obtained from the use of nitrogen, and from Fields 4 and 6 a profit of £3 6s. 6d. and £3 19s. per acre respectively. In the case of Field 8, however, the application of nitrogen showed a loss of £3 2s. 5d. per acre. Taking the average of all fields under trial, the total revenue from those fields treated with nitrogen and phosphate was £16 13s. 6d. per acre, as against £13 13s. 7d.

Table 2.—Comparison of Costs between Fields treated with Nitrogen and Phosphate against Phosphate alone, at Per-acre Values

Field No.	Value of Butterfat.		Value of Dry-stock grazed		Total Value.		Difference per Acre.	Cost of Nitrogen per Acre.	Profit or Loss per Acre.
	Phosphate plus Nitrogen.	Phosphate.	Phosphate plus Nitrogen.	Phosphate.	Phosphate plus Nitrogen.	Phosphate.			
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
2	16 4 5	14 3 7	0 16 10	0 13 7	17 1 3	14 17 2	2 4 1	1 17 6	0 6 7 P.
4	18 8 0	13 11 8	1 3 5	0 15 9	19 11 5	14 7 5	5 4 0	1 17 6	3 6 6 P.
6	14 5 6	8 2 0	0 12 4	0 19 4	14 17 10	9 1 4	5 16 6	1 17 6	3 19 0 P.
8	14 1 7	15 19 6	1 2 0	0 9 0	15 3 7	16 8 6	1 4 11	1 17 6	3 2 5 L.
Average per acre	15 14 10	12 19 2¼	0 18 8	0 14 5	16 13 6	13 13 7	2 19 11	1 17 6	1 2 5

per acre from those fields treated with phosphate alone, a difference of £2 19s. 11d. per acre in favour of the nitrogen-treated fields. Deducting the average per-acre cost of nitrogen, it then appears that the application of sulphate of ammonia to the Winton Experimental Farm pastures resulted in a profit of £1 2s. 5d. per acre, out of which the railage of manures and cost of application has to be met.

As a result of an analysis in regard to the grazing obtained during the various periods it is to be recorded that on every field there are more dry-stock days on the nitrogen-treated halves for the first two periods than on the phosphate halves, with one exception. This would point very clearly to inefficient utilization of grass by milking-cows. If this is so, then this inefficiency was in all probability caused by allowing the grass to grow too long before the cows were put on, with the result that they could not be made to clean it up without decreasing in milk-yield.

Assuming that good use of the field had been made by milking-cows and that exactly the same number of dry-stock days had been required to clean up the nitrogen fields as was the case with the phosphate ones, there would have been an average of about eighteen more cow days per acre on the nitrogen fields. Since a cow day produces about 1 lb. of butterfat at 1s. 4d., the extra cow days would have given eighteen times 1s. 1d. (1s. 4d., less 3d., for each dry-stock day) greater financial return.

It has to be admitted that several anomalies in the results have occurred which are difficult to explain, but a general summary of the season's work at Winton in rotational grazing and intensive manuring does not show the high returns which might have been expected from the use of soluble nitrogen.

It is impossible to say what the effect has been on subsequent production of the herd of having grass earlier than would have been the case had nitrogen not been used. The saving of supplementary fodder, however, must have amounted to several shillings per acre.

Potato Manurial Trials.

A series of potato manurial trials designated A, B, C1, and C2 were laid down with a view to determining the effects of various fertilizers. The outline and results of these experiments are briefly summarized as follows:—

Experiment A.—The object of this experiment was to determine to what advantage superphosphate in excess of 3 cwt. per acre would be beneficial to the potato crop. Ten replications of the following treatments were made: Super 44–46 per cent., 3 cwt., 5 cwt., and 7 cwt. per acre. Table 3 summarizes the results.

Table 3.—Summary of Yields in Experiment A.

All yields are averages from ten weighings.

Treatment per Acre.	Yield and Increase per Acre.			
	Table.	Seed.	Small.	Total.
	Tons.	Tons.	Tons.	Tons.
No manure	1·0	0·6	0·4	2·0
Super 3 cwt.	2·1	1·0	0·7	3·8
Increase over no manure ..	1·1 (S)	0·4 (S)	0·3 (S)	1·8 (S)
Super 5 cwt.	2·2	1·1	0·9	4·2
Increase over super 3 cwt. ..	0·1 (NS)	0·1 (NS)	0·2 (NS)	0·4 (NS)
Super 7 cwt.	2·5	1·1	0·8	4·4
Increase over super 3 cwt. ..	0·4 (S)	0·1 (NS)	0·1 (NS)	0·6 (S)
Increase over super 5 cwt. ..	0·3 (NS)	0·0 (NS)	−0·1 (NS)	0·2 (NS)

NOTE.—(S) denotes that increases are statistically significant, (NS) not significant. This applies to all tables where occurring.

It will be seen that a steady increase in yield with increasing quantities of super was recorded, but the differences between super 3 cwt. and super 5 cwt., and between super 5 cwt. and super 7 cwt., were not significant.

Experiment B.—The object of this trial was to determine the effect of using nitrogen and potash as adjuncts to superphosphate in the manuring of potatoes. Ten replications of each treatment were carried out, with the following results, as shown in Tables 4 and 5.

Table 4.—Summary of Yields in Experiment B.

Treatment per Acre.	Yield per Acre.			
	Table.	Seed.	Small.	Total.
	Tons.	Tons.	Tons.	Tons.
Super 3 cwt.	2·3	0·7	0·5	3·5
Super 3 cwt. plus sulphate of ammonia 1 cwt.	3·5	0·8	0·5	4·8
Super 3 cwt. plus sulphate of ammonia 1 cwt. plus potash 1 cwt.	3·0	0·6	0·6	4·2
Super 3 cwt. plus potash 1 cwt. ..	2·2	0·5	0·5	3·2
Super 3 cwt. plus sulphate of ammonia 2 cwt.	2·8	0·5	0·5	3·8

Table 5.—Summary of Differences between Treatments in Experiment B.

Treatment per Acre.	Differences per Acre.			
	Table.	Seed.	Small.	Total.
	Tons.	Tons.	Tons.	Tons.
Super 3 cwt. plus sulphate of ammonia 1 cwt.—				
Increase over super 3 cwt. ..	1·2 (S)	0·1 (NS)	0·0	1·3 (S)
Increase over super 3 cwt. plus sulphate of ammonia 1 cwt plus potash 1 cwt.	0·5 (NS)	0·2 (NS)	—0·1 (NS)	0·6 (NS)
Increase over super 3 cwt. plus sulphate of ammonia 2 cwt.	0·7 (S)	0·3 (NS)	0·0	1·0 (S)
Super 3 cwt. plus sulphate of ammonia 1 cwt. plus potash 1 cwt.—				
Increase over super 3 cwt. ..	0·7 (S)	—0·1 (NS)	0·1 (NS)	0·7 (S)
Increase over super 3 cwt. plus potash 1 cwt	0·8 (S)	0·1 (NS)	0·1 (NS)	1·0 (NS)
Super 3 cwt plus potash 1 cwt.—				
Decrease from super 3 cwt ..	0·1 (NS)	—0·2 (NS)	0·0 (NS)	—0·3 (NS)
Super 3 cwt. plus sulphate of ammonia 2 cwt —				
Increase over super 3 cwt ..	0·5 (S)	—0·2 (NS)	0·0 (NS)	0·3 (NS)

An analysis of Tables 4 and 5 shows that the application of 3 cwt. of super plus 1 cwt. of sulphate of ammonia gave the best yield. Potash appears to have had no effect in increasing yields, and the application of 2 cwt. of sulphate of ammonia does not appear warranted.

Experiment C.—This experiment was designed to determine the relative merits of superphosphate plus sulphate of ammonia, and the newer ammonium phosphates. The experiment was divided into two —C1 and C2.

Table 6.—Summary of Yields in Experiment C1.

Each yield is the average of ten weighings

Treatment per Acre	Yields and Increases per Acre.			
	Table.	Seed.	Small.	Total.
	Tons.	Tons.	Tons.	Tons.
Super 3 cwt. plus potash 1 cwt. ..	1·8	1·1	0·9	3·8
Super 3 cwt. plus Ammophos plus potash 1 cwt.	3·0	1·3	1·2	5·5
Increase over super 3 cwt. plus potash 1 cwt.	1·2 (S)	0·2 (NS)	0·3 (S)	1·7 (S)
Ammophos plus potash 1 cwt. ..	2·6	1·1	1·0	4·7
Increase over super 3 cwt. plus potash 1 cwt.	0·8 (S)	0·0	0·1 (NS)	0·9 (S)
Diammonphos plus potash 1 cwt	3·1	1·4	1·2	5·7
Increase over Ammophos plus potash 1 cwt.	0·5 (NS)	0·3 (NS)	0·2 (S)	1·0 (NS)

Table 7.—Summary of Yields in Experiment C2

Each yield is the average of eight weighings.

Treatment per Acre.	Yields and Increases per Acre.			
	Table.	Seed.	Small.	Total.
	Tons.	Tons.	Tons.	Tons.
Super 3 cwt. plus potash 1 cwt. ..	1·9	1·8	1·8	5·5
Super 3 cwt. plus sulphate of ammonia plus potash 1 cwt.	3·0	1·9	2·1	7·0
Increase over super 3 cwt plus potash 1 cwt.	1·1 (S)	0·1 (NS)	0·3 (S)	1·5 (S)
Increase over Ammophos plus potash 1 cwt.	0·3 (S)	0·3 (S)	0·1 (S)	0·7 (S)
Ammophos plus potash 1 cwt. ..	2·7	1·6	2·0	6·3
Diammonphos plus potash 1 cwt.	2·6	1·7	2·0	6·3
Increase over Ammophos plus potash	—0·1	0 1	0·0	0·0

With regard to the last two tables, it is to be noted that the difference between Ammophos plus potash and Diammonphos plus potash are not significant when the two experiments are taken together.

Time of Application of Fertilizers in Pasture Top-dressing.

An experiment was laid down in June, 1929, with the dual object of ascertaining (1) the effect on production of applying superphosphate in winter, spring, summer, and autumn, and winter plus summer, and (2) to determine the effect of applying nitrogen in the form of sulphate of ammonia in June and March. The lay-out of the plots, totalling 168, was designed by the Crop Experimentalist, and his findings on this experiment will be published in due course when dealing with others of a similar nature laid down elsewhere.

Mangel Variety Trial.

A mangel variety trial was conducted, six varieties being sown, with a dressing of 3 cwt. of agricultural salt broadcast and worked in with 4 cwt. superphosphate, 1 cwt. sulphate of ammonia, and 1 cwt. potash salts. Owing to a poor strike and the necessity for transplanting, weights were not taken, but observations made throughout the growing-period resulted in the varieties being placed in the following order of merit: (1) Long Red, (2) Prize-winner, (3) Jersey Queen, (4) White Knight, (5) Golden Tankard, (6) New Combination.

Trial on Origin of Seed Potatoes.

This trial was laid down as one of a series being conducted in various parts of the Dominion by the Agronomist, with the object of ascertaining what districts are most suited for the production of seed potatoes. Approximately ¼ acre was planted with Arran Chief seed obtained from Ashburton. The crop made fair growth, but the yield was very disappointing, amounting in all to 7·2 tons per acre. Of this yield 1·7 tons were graded table size, 3·6 tons seed, and 2·1 tons small. The yield, however, was in keeping with those obtained from other plots in

different districts which had been planted with seed of the same line. Two hundred pounds of seed was sent to Ashburton Experimental Farm to be grown there, and a sufficient quantity was retained to carry on the investigation for another year at Winton.

Grass and Clover Strains.

Rye-grass: A comprehensive series of plots were hand sown in Field 7 during late October and early November, 1929. Some 200 plots, including rye-grass from different colonial sources and of imported origin were sown in accordance with the scheme formulated by the Agrostologist. These plots, although competing with a heavy growth of yarr (spurrey), made excellent progress, and the differences are now quite striking, showing up the early maturity of the Canterbury lines, the intermediate position occupied by Southland lines, and the relatively slow establishment of many of the best perennial types from Hawke's Bay, Poverty Bay, and Sandon. This trial occupies an area of 4 acres.

Cocksfoot and Red and White Clover: A series of 200 plots corresponding to the rye-grass trials were sown in Field 5. A good perennial line of Hawke's Bay rye-grass was used throughout as a base sowing. By January, 1930, the Danish types of cocksfoot could be easily differentiated on account of their taller and more open habit of growth.

Oats Manurial Experiment.

An experiment was laid down on 5th November, 1928, with Garton oats. A seeding of 3 bushels per acre was used, and the manurial treatments were as follows:—

(1) Superphosphate 2 cwt.
(2) Super 2 cwt. and sulphate of potash 1 cwt.
(3) Super 2 cwt. and sulphate of ammonia 1 cwt
(4) Super 2 cwt., sulphate of ammonia 1 cwt, and sulphate of potash 1 cwt.

Note.—The sulphate of ammonia was applied by hand on the 19th December, 1928.

The crop was harvested on 15th March, 1929, with results as follows:—

Table 8.—Results of Oats Manurial Experiment.

Each yield is the average of twenty weighings each 1 chain 53 ft. by 4 ft. 1 in.

Treatment per Acre.	Yields per Acre.	Increase over Super 2 cwt.	Chaff equivalent as Percentage of Weight when cut.
	Tons.	Tons.	
(1) Super 2 cwt.	3·5	..	61·0
(2) Super 2 cwt. and sulphate of potash 1 cwt.	3·8	0·3 (S)	61·0
(3) Super 2 cwt. and sulphate of ammonia 1 cwt.	4·2	0·7 (S)	61·4
(4) Super 2 cwt., sulphate of ammonia 1 cwt., and sulphate of potash 1 cwt.	4·2	0·7 (S over super and super plus potash)	63·5

All nitrogen plots showed taller growth and later maturity. No difference due to potash could be noticed. The oats experiments are being pushed forward a step further in the current season.

Top-dressing of Pastures.

Blocks 1, 3, and 9 have been top-dressed, as in previous years, with various phosphatic manures, including super, basic slag, Seychelles phosphate, and Nauru. Carbonate of lime and crushed burnt limestone applied in previous years as cross-dressings in these fields still continue to show quite marked improvement in colour, also in clover and bottom growth. Both sheep and cattle show a preference for the limed areas, even though the limestone was applied as far back as 1925 in some instances.

Ensilage.

In March, 1929, some 4 acres of oats and tares was ensiled in a small pit about 6 ft. deep. This crop was a little over-ripe, and owing to insufficient labour at time of ensiling the operation was unduly prolonged. This allowed the temperature to run high, and a brown silage resulted. The loss of silage at the pit-mouth was not warranted, and disclosed the weakness of not tramping the material hard at this point.

During the winter some 20 tons of the silage was fed out to dry cows, and feeding was continued after the herd came to profit; no difficulty was experienced in getting the cows to take to it. As soon as the herd was placed on the lush grass in the rotational-grazing trial fields the feeding of silage was discontinued.

Raising of Fat Lambs.

In March, 1928, a small flock of Romney Marsh cross 2-tooth ewes was divided into five groups, and each group mated with a different breed of ram, comprising Shropshire, Ryeland, Border Leicester, English Leicester, and Southdown. Lambing commenced in October, and all the lambs were sold by March. The results were as follows :—

Table 9.—Results of Lamb Trials.

Ram.	Lambing Percentage.	Percentage of Fat Lambs.	Average Dressed Weight.
			lb.
Border Leicester ..	100	60	35·92
English Leicester ..	75	60	34·89
Southdown	85	53	34·78
Ryeland	73	64	32·67
Shropshire	68	100	31·69

The experiment could not be considered very conclusive. A heavy growth of grass, combined with a wet season, caused foot trouble among the ewes, and this seriously affected their condition. After the foot trouble had been cleaned up the lambs were placed on to small breaks of rape and oats, and were then fattened off on a swede crop which had proved a failure owing to club-root infection.

KENTISH WILD WHITE CLOVER.

A portion of Fields 8A and 8B (which were originally laid down in pasture in 1926) was given Kentish wild white clover in the mixture at the rate of 2 lb. per acre, in place of the New Zealand white clover sown on the remainder of the area. Since 1928 the Kentish wild white portion has been markedly superior to the remainder of the area. An observer would come to the conclusion that the former portion had either been sown out in different grasses or had received special manurial treatment. The grass-growth throughout this part is definitely superior, the colour is a darker green, and the stock show a particular liking for it. The Kentish wild white clover is much later in flowering in the autumn, but its most striking feature is its dense spreading cover growth.

GENERAL.

A field-day in March, 1929, was attended by some sixty farmers. In October of the same year the visiting Tasmanian farmers, in company with local farmers, also paid a brief visit and inspected the various pasture blocks. A new departure was made by holding a field-day in December, so that farmers might view the various pasture blocks at a particularly interesting stage.

During the period under review the Winton Experimental and Demonstration Farm Committee acted under the able chairmanship of Mr. D. H. McLean, of Caroline. Mr. G. L. Smart took over his duties as manager of the farm in August, 1928, and the amount of work that has been accomplished during the period is largely owing to his enterprise and industry. The experimental side and general supervision were in the hands of Mr. G. W. Wild, late Instructor in Agriculture, Invercargill.

DUSTING *VERSUS* SPRAYING FOR FUNGUS CONTROL.

IN America especially there has been a tendency to replace sprays with dusts, owing to the ease of application of the latter, and numerous requests have been received from New Zealand growers as to which is the more efficacious method.

Experiments conducted in America and England over a period of years have shown that in a normal season there is little difference in yields of sprayed or dusted plots; but in an epiphytotic season—that is, a season in which blight is very severe—spraying is much more effective. The reason for this is that dusts do not adhere well to the foliage, over 50 per cent. being lost within one week after application; consequently, although sufficient copper is present in a normal season to check the weak development of fungi, it does not suffice in an abnormal season (where the moisture on leaves is considerably in excess) to inhibit fungus attack.

A second feature is that in New Zealand dust costs at least three times as much as sprays, whereas in America the cost is only slightly in excess of sprays, and as considerably greater quantities are required, the practice is really too expensive, despite the considerable saving in time and labour, for our conditions.

A third feature is that, as bordeaux is seldom prepared correctly, dusts have often shown better results in experiment than would normally be the case if hydrated-lime bordeaux were used (which eliminates the uncertainty of faulty preparation), and for this reason many of the field experiments conducted overseas cannot be considered reliable.

—*Mycological Laboratory, Plant Research Station.*

BUSH - SICKNESS INVESTIGATION.

NOTES ON SOME RECENT RESULTS.

B. C. ASTON, Chief Chemist, Department of Agriculture.

THE area now known as the Mamaku Demonstration Farm was acquired in 1912 by purchase for the purpose of investigating the deficiency disease called "bush sickness," which was hindering the development of a very large area of country quite capable of growing healthy pasture but which would not grow healthy ruminants (cattle and sheep). This particular disease exists in varying degrees of severity on many areas in the North Island situated in various positions from sea-level to 2,000 ft.

The Mamaku Farm represents an area which may be roughly computed at 50,000 acres of country, originally densely forested, and remarkably uniform in vegetation, physical features, and history. Timber-milling was the main industry of this area, situated about 1,760 ft. above sea-level, of almost flat land, intersected by a network of tram-lines for getting out timber, and crossed by the Auckland–Rotorua Railway. On maps the area may be located as part of the Patatere Plateau, which has been referred to as the Mamaku Plateau. As might be expected, the winter conditions of this inland elevation are fairly severe, and must be counted an added condition antagonistic to the health of stock weakened by malnutrition.

Thus, although there may be areas more severely afflicted with bush sickness than Mamaku, the climatic conditions in these areas are generally milder, so that Mamaku may be accepted as a useful experimental area with easy means of access by rail and road, and any method of treatment found successful would be applicable to a far wider area than that represented by the Mamaku Farm.

DEVELOPMENT OF DAIRYING AT MAMAKU.

Dairying has been carried out on the demonstration farm for the last sixteen years. Land has been stumped, ploughed, and cropped, and over 100 acres of improved pasture has been established. This is top-dressed with phosphates from time to time, the favourite dressing being a mixture of slag and superphosphate, the slag supplying a considerable percentage of iron. Under this treatment it has been a matter of general remark that the older paddocks are becoming more healthy for stock, and it is now considered that stock may be carried on some of them without treatment of a special nature to combat the bush sickness.

During the past year a number of pasture-samples have been drawn from the old improved paddocks, and these show more than twice the quantity of iron that samples show on the untreated paddocks or on bush-sick lands in the vicinity. The accompanying table shows the results of analyses. The alumina content of the sample is an indication of the extent to which it is contaminated by soil. One would therefore regard No. 6648 as undoubtedly showing more iron than is contained by the plant.

Analyses of Pasture Samples from Mamaku and Rotorua Areas.

Results are expressed as percentages. Chemical analyses are calculated on the material dried at 105° C.

Lab. No.	Date taken.	Manurial Treatment and Remarks.	Locality.	Ash.	Soluble Ash.	Silica (SiO_2).	Iron (Fe).	Alumina (Al_2O_3).	Phosphoric Acid (P_2O_5).	Lime (CaO).	Magnesia (MgO).	Manganese (Mn).	Chlorine (Cl).	Nitrogen (N).	Carbon Dioxide (CO_2).	Botanical Analyses: Grasses.	Botanical Analyses: Legumes.	Botanical Analyses: Weeds.
Old improved Paddocks at Mamaku, and healthy Paddocks at Te Ngae.																		
6647	16/11/29	Dressed in past with super, and last three years annually with 3 cwt. super and slag per acre (1:1). No. 3 paddock	Mamaku Farm	8·66	7·95	0·71	0·027	0·025	1·20	0·97	0·43	0·023	0·83	4·60	..	73	26	1
6798	27/3/30	Down ten years. Last two years dressed with 3 cwt super and slag; had four dressings during previous eight years. No. 2A paddock	Mamaku Farm	10·17	8·71	1·45	0·020	0·046	1·05	0·81	0·11	0·022	1·06	4·64	..	90	10	0
6799	27/3/30	1927: Crop swedes with 1½ cwt. super and slag. 1928: Crop oats with 1 cwt. blood-and-bone and some kainit. March, 1929: Sown in grass with 3 cwt. super and slag; dressed in November, 1929, with same mixture. No. 7B paddock	Mamaku Farm	10·87	9·07	1·80	0·020	0·052	0·95	0·71	0·39	0·031	1·29	4·16	..	92	7	1
6801	27/3/30	Had 3 cwt. super, three and a half and one and a half years ago. Haystack paddock, extremely free from sickness	Te Ngae	10·71	7·28	3·43	0·017	0·043	0·47	0·83	0·50	0·019	0·92	3·37	..	75	23	2
Newer Paddocks at Mamaku and Elsewhere.																		
6648	15/11/29	Unmanured paddock ..	Mamaku Farm	8·03	6·28	1·74	0·013	0·110	0·65	0·60	0·37	0·036	0·78	3·90	..	90	8	2
6797	27/3/30	2 cwt. super in spring and autumn, 1929. Old lupin paddock. Growth after cutting for hay	Te Pu ..	8·89	7·40	1·49	0·009	0·056	0·74	1·57	0·48	0·024	0·68	3·58	..	69	30	1
6800	27/3/30	Unmanured paddock ..	Mamaku Farm	9·96	6·85	3·11	0·013	0·035	0·62	0·48	0·35	0·048	1·07	3·65	.	96	2	2

Analyses of Pasture Samples—continued.

Lab. No.	Date taken.	Manurial Treatment and Remarks.	Locality.	Ash	Soluble Ash.	Silica (SiO_2).	Iron (Fe).	Alumina (Al_2O_3)	Phosphoric Acid (P_2O_5).	Lime (CaO)	Magnesia (MgO).	Manganese (Mn).	Chlorine (Cl).	Nitrogen (N)	Carbon Dioxide (CO_2).	Botanical Analyses		
																Grasses	Legumes.	Weeds.
				Newer Paddocks at Mamaku and Elsewhere—continued														
6802	12/3/30	5 cwt. spathic iron ore January, 1930. Spathic iron paddock No. 6	Kaharoa	9·62	7·02	2·60	0·011	0·035	0·48	0·91	0·47	0·033	1·06	3·38	..	72	23	5
6803	12/3/30	In 1927 and again in 1928 had 3 cwt. Nauru phosphate, 1 cwt. sulphur, ½ cwt. sulphate of iron. October, 1929, 3 cwt. Nauru, ½ cwt. sulphur, ½ cwt. sulphate of iron. No. 4 paddock	Kaharoa	9·79	7·81	1·97	0·011	0·031	0·87	1·04	0·42	0·035	1·10	3·89	..	68	28	4
6823	13/3/30	Super only No manure for three years No iron applied Control paddock	Kaharoa	9·74	6·72	3·02	0·010	0·045	0·49	0·89	0·48	0·051	1·06	2·60	..	77	19	4
6926	6/11/29	Unmanured paddock ..	Te Pu ..	9·16	7·63	1·53	0·010	0·043	0·59	1·18	0·45	0·032	1·06	3·05		69	16	15
				Pure Species free from Soil Contamination														
77	10/2/30	Top dressed with 2½ cwt. super and slag. White clover sown autumn, 1929 Next old super paddock. Shut up for few weeks after having been cut for ensilage. Clean, green growth	Te Pu ..	8·70	8·26	0·44	0·010	0·023	0·90	2·43	0·41	0·021	0·42	4·43	..	..	..	..
2062	10/2/30	Red clover; clean, green, young growth. Paddock shut up for three weeks Old super paddock	Te Pu ..	10·40	10·03	0·37	0·009	0·022	0·91	2·57	0·72	0·020	0·64	5·16	2·95	.	..	..
2063	10/2/30	Red clover. Same paddock as No 77 (white clover)	Te Pu ..	9·37	9·11	0·26	0·008	0·025	0·85	2·99	0·57	0·016	0·31	4·93	2·85	.	.	..
4057	14/5/30	Cocksfoot; green manure paddock. 2 cwt. super, autumn and spring, 1929	Te Pu ..	11·12	8·17	2·94	0·011	0·047	1·51	0·61	0·46	0·048	1·19	4·13		..	..	.
4062	10/2/30	Cocksfoot; old super paddock. Same as 2062	Te Pu ..	9·96	7·13	2·83	0·008	0·023	0·89	0·98	0·53	0·029	0·103	3·41	0·88	..	.	.

Analyses by F. B. Thompson and P. H. Sykes.

Experiments with Sheep.

It is a well-known fact that in some areas bush sickness does not affect cattle, but that sheep suffer badly, which may be interpreted as a sign that such land is less bush-sick than that on which cattle cannot be continuously pastured. There are very large areas which are what naturally would be considered suitable sheep-country—tussock land, danthonia, and scrub country—but on which, nevertheless, sheep cannot be raised.

It is satisfactory to state that experiments which have been under way over six months on a block of this type of country near Rotorua where the runholder has been unable to raise his lambs hitherto are now indicating that it will be economically possible to treat all the sheep (some 1,800 in this case) with a lick composed of salt and native iron carbonate, and that as a result the sheep can be kept healthy and the lambs raised successfully.

It may be recalled that an experiment with sheep at the Mamaku Farm (see this *Journal* for July, 1930, page 10) proved that a small flock of sheep going sick after a year's grazing could be brought back to health by means of iron and ammonium-citrate pellets and pastured for a further year, enabling them to be sold fat. There is no doubt that this success was due to the iron treatment. In the mass experiment at Rotorua, mentioned above, the treatment was with a large mob of sheep and carried out on the farm of a practical runholder with an iron remedy obtained locally. The control animals are becoming completely bush-sick, while the mob of lick-treated sheep and the smaller lot of pellet-treated sheep are doing well at the date of writing (27th November, 1930). The experiments are under the supervision of Mr. C. R. Taylor, Analyst's Assistant, stationed at Rotorua. As a very large area of this class of country occurs from Rotorua to the coast, wherever there is a light porous topsoil, runholders having any difficulty with malnutrition in sheep akin to bush sickness should watch for the complete report to be published in the *Journal*.

Another method of automatically administering the iron remedies to stock is by incorporating them with hay or ensilage when either of these is being made, and a number of experiments are being undertaken by Mr. Taylor in this direction.

Importation of Stud Stock from Abroad.—Owing to conditions regarding foot-and-mouth disease in Great Britain (states the annual report of the Live-stock Division for 1929-30) a prohibition still exists on the importation of cattle, sheep, and swine from there, and up to the present it has not been possible to take steps to lift the embargo. At present the only countries from which cattle may be imported into New Zealand are Tasmania, Canada, and the United States (with the exception of the State of [illegible]), while swine may be introduced only from Tasmania and Canada. Ca[illegible] swine from these countries must be quarantined on arrival in the Dominion. The following imported animals were placed in quarantine during the year for the prescribed period: Horses, 1; cattle, 41; sheep, 7; swine, 4; dogs, 44.

BOYS' AND GIRLS' AGRICULTURAL CLUBS.

RECORD OF ACTIVITIES IN 1929–30 SEASON.

(Continued.)

2. Otago and Southland Districts.

J. E. DAVIES, Instructor in Agriculture, Dunedin.

LOCAL crop competitions for boys and girls were inaugurated in Otago early in 1919 under the auspices of the Otago Expansion League, and have been continued annually in co-operation with the local Farmers' Unions and Department of Agriculture. In the initial stages, however, competitions were limited to comparatively few districts, due to the fact that there did not exist a controlling organization working solely in the interests of an agricultural club movement. The agricultural club activities in Southland have reached a high status, largely due to the encouragement and energy of the controlling committee. The associated clubs have now completed their second season's work, and judging by the large number of entries in the wide range of competitions it appears that the Association is working on a progressive basis.

SOUTHLAND.

CALF-REARING COMPETITION.

The inauguration of a calf-rearing competition received consideration by the executive, and it was, in the first place, resolved to defer this class of competition to the 1930–31 season. So keen, however, was the desire of members in the dairying districts for the establishment of calf-clubs that it was eventually decided to start a few, mainly with the object of procuring information for the launching of a suitable scheme the following year. Clubs were accordingly formed in the Makarewa, Kennington, Edendale, and Wyndham School Districts. A total of thirty-eight calves which were the offspring of purebred bulls and born between 1st and 31st October, were entered in the competition. All the calves were tattooed to avoid the possibility of substitution taking place.

Judging of the calves was carried out at various school centres during the latter part of February, Mr. R. H. Dickie and Mr. G. W. Wild, late Instructor in Agriculture, Invercargill, being the judges in all districts. For the purpose of uniformity, calves were paraded in two classes—(1) large breeds (Friesian and Shorthorn), (2) small breeds (Jersey and Ayrshire). The maximum standard of judging points was: Condition, 40; dairy type, 35; record chart, 25. At all centres keen interest was evinced at the judging parades, and, in addition to the presence of competitors, teachers, pupils, and parents, a large number of farmers attended, which augurs well for the future of this phase of club work. At the parades demonstrations on dairy type, and short talks on the management and rearing of calves, &c., were given by the judges. That the competitors had tended their animals with care to feeding and management was depicted in the excellent condition of the animals and their docility when on parade, and the judges had some difficulty in placing the winners.

Substantial cash prizes were awarded to the three placed competitors in each class. Olive Dunn, Edendale School, with a total of 90 points out of 100, secured the championship, and was the winner of the Reginald MacKinnon Trust medal awarded for the highest aggregate points in the competition. Edward Callighan, Makarewa School, was given second place with 89 points. Both calves and the feeding record charts were a feature of a special display at the Invercargill Winter Show. Special prizes were given for most points in condition and dairy type only, and most points in record keeping.

CALF-JUDGING PARADE AT EDENDALE SCHOOL, FEBRUARY, 1930.

The calf owned by Winnie Smith, Wyndham, was judged the winner, while Herbert Dunn, Edendale, carried off the honours with an excellently kept feeding record.

CROP-GROWING: POTATOES AND MANGELS.

The potato-growing competition inaugurated in 1928–29 was repeated in last season's programme. Provision was also made for a mangel-growing competition, and although mangels are not grown to any great extent in Southland the possibilities of this c... were deemed worthy of consideration. The competition was dividea ..to two divisions for the purpose of equalizing the disparity in competitors' ages. The Intermediate Division included competitors over twelve and under sixteen years of age, and the Junior Division was for those under twelve. The plots for the former were $\frac{1}{40}$ acre and for the latter $\frac{1}{70}$ acre. In both divisions the variety of mangel grown was the same—namely, Prizewinner Yellow Globe; but in the potato-growing competition the varieties differed, being Up-to-Date for the Intermediate and Arran Chief for the Junior Division.

Some phenomenal potato-yields were recorded. The number of plots abandoned were comparatively small when seasonal conditions are taken into consideration, most of the plots having suffered severely by frosts experienced in December. It was gratifying to note the number of plots which were sprayed as a preventive against blight. The mangel plots were rather late in being sown, and in several districts

were almost ruined in the early stages by heavy hailstorms, but although the average yield was low the quality of the roots was excellent.

Summary of Results.

Number of schools entered, 66; number represented at final judging, 58.

Number of competitors entered: Potato-growing, 358; finally judged, 276. Mangel-growing, 40; finally judged, 25.

Total number of plots ruined by weather conditions, stock, ill health of competitors, &c., 98.

Heaviest-yielding crops: Potatoes—Up-to-Date, 32 tons 2 cwt. per acre; Arran Chief, 30 tons 16 cwt. per acre. Mangels, 56 tons 5 cwt. per acre.

Average per acre yield of crops: Potatoes—Up-to-Date, 12·8 tons; Arran Chief, 14·2 tons. Mangels, 30 tons.

Approximate total area and value of potato crop: Area grown, $5\frac{1}{2}$ acres; yield, $74\frac{1}{4}$ tons; estimated value of table and seed potatoes (68 tons), £500.

In the potato-growing competition each division was divided into five groups, and in the mangel competition into two groups. As in the calf-rearing competition, cash prizes were again awarded to the three placed competitors in the Intermediate Division and to the four placed competitors in the Junior Division. In the crop competition alone a total of forty-nine cash group-prizes were awarded.

Trophy Winners.

Since the inception of agricultural-club activities in the Southland District the Stuart Wilson Dominion Challenge Cup for annual competition has on both occasions been awarded to competitors in the potato-growing competition, the 1929–30 season's winner being James Glynn, Eastern Bush School, an Intermediate Division competitor who grew an outstanding crop of Up-to-Date potatoes yielding at the rate of 32 tons 2 cwt. per acre, exceeding the preceding year's record by 17 cwt. The actual per-acre returns on grading were: Table, 16 tons 5 cwt.; seed, 14 tons 8 cwt.; pig, 2 tons 9 cwt. When assessed on a basis of table £6, seed £5, and pig £1 per ton, the calculated value of the crop was £171 19s. per acre. The cup was displayed at a presentation function held at the school in October, and the Fields Superintendent, Dunedin, presented the winner with the Department of Agriculture's gold medal and a photograph of the cup.

The silver shield of the Southland Council of the New Zealand Institute of Horticulture, valued at £30, awarded to the school gaining the highest average aggregate points in the practical field-work in the crop-growing competition, was won by Lora Gorge School with $59\frac{1}{4}$ points, closely followed by Knapdale School with $58\frac{1}{2}$ points.

The Southland Provincial Farmers' Union shield, valued at £12 12s., for the school gaining the highest average aggregate points over all phases of work in crop-growing, was won by the Knapdale School with $85\frac{1}{2}$ points, Lora Gorge School being close second with $84\frac{1}{2}$ points.

Championships (Also Winners of the Reginald MacKinnon Trust Medallions).

The championship results were as follows :—

	Yield per Acre. Tons	cwt.	Total Points.	Place.
Potato-growing —				
Intermediate Division—				
Adrian Miller, Gore	20	9	89½	1st
Reta Moir, East Chatton	17	3	88¾	2nd
Junior Division—				
Eric Middleton, Lora Gorge	17	3	89½	1st
James Patterson, East Chatton	22	4	89	2nd
Mangel-growing :—				
Intermediate Division—				
Lex Gerrard, Winton	56	5	89½	1st
Spence Parcell, Seaward Downs	40	19	87¾	2nd
Junior Division—				
Murray Cushen, Edendale	39	16	85¼	1st
Vernon Pont, Colac Bay	34	1	84¾	2nd

Special Prizes.

Special prizes were awarded as follows :—

Potato-growing : Most Points in Field-work :—
Intermediate Division—Charles Grace, Redan, 49 points (maximum 50).
Junior Division—Charles Tapper, Waimatua, 49½ points.

Best Record Chart.

Intermediate Division—Reta Moir, East Chatton, 29½ points (maximum 30).
Junior Division—William Smith, Waikaka Valley, 27¼ points.

Mangel-growing : Most Points in Field-work :—
Intermediate Division—Spence Parcell, Seaward Downs, 49 points (maximum 50).
Junior Division—Raymond Evans, Long Bush, 49½ points.

Best Record Chart

Intermediate Division—Herbert Dunn, Edendale, 28¾ points (maximum 30).
Junior Division—Gordon MacKenzie, Redan, 26½ points.

Judging of Crops.

The initial judging of plots in regard to cultivation, management, and appearance was carried out during the month of February by supervisors and teachers of each school district, who jointly inspected each plot and submitted a standardized progress report thereon. Following this, during March and early April, a minimum of the two best plots in each school district was inspected and reported on by the Instructors of the Agriculture and Education Departments, and all progress reports were standardized accordingly.

The large number of potato plots to be weighed for yield points caused the Association considerable concern, and to overcome this difficulty a scheme was evolved under which standard instructions were issued to supervisors and teachers to dig a representative area and forward the quota of potatoes therefrom to Dunedin, where each competitor's lot was weighed and graded. Accompanying each lot a declaration form was submitted giving full particulars as to width of drills, &c. The scheme has much to commend it, proving economical with a standard system of weighing and grading.

The mangel crops were left until June and weighed in the field, all weighing being carried out by Instructors of the Agriculture

Department. Crops were judged on a maximum point basis of cultivation, 20; general appearance, 30, and records, 30. For the purpose of eliminating the differences in soil-variation the following system of allotting yield points was adopted: Potato crops, 1 point for each ton up to 12 tons, and $\frac{1}{4}$ point for each succeeding ton; mangel crops, 1 point for every 3 tons up to 36 tons, and $\frac{1}{4}$ point for each succeeding 3 tons. For example, a yield of 12 tons of potatoes per acre received the same number of points as a yield of 36 tons of mangels per acre—namely, 12 points. This method proved excellent, and was most successful in deciding trophies awarded for most points in crop-growing.

The outstanding feature of the season's work was the marked improvement in record-keeping. Out of a maximum of 30 points an average of 20·4 points were obtained over the 300 competitors, as against an average of 13·5 points over the 147 competitors in the previous season The crop-growing organization is now becoming fully understood, and it is the intention of the executive to further extend this work so as to cover the main field-crops.

Otago District.

Club activities in Otago were confined to a potato-growing competition in the Milton district, which was controlled by a local committee organized by the Milton Farmers' Union in conjunction with the Department of Agriculture and Otago Expansion League.

All competitors were grouped in one class, the size of the plots was $\frac{1}{40}$ acre, and they were judged on a similar basis to that of the Southland district. Maximum points were allotted as follows: Cultivation, 20 points; general appearance and management, 30; records 10; yield, 50. The variety of potato grown was Arran Chief. Twenty-two competitors entered. Keen interest and excellent field-work was shown throughout the year, but the record keeping left much to be desired.

The following competitors gained the winning places:—

	Yield per Acre. Tons cwt.	Points (Maximum 110).	Place.
Hazel Bain	22 14	101$\frac{3}{4}$	First
James Wood	21 9	101$\frac{1}{4}$	Second.
William Lyon	23 19	100	Third.
Ian Finch	20 15	99$\frac{3}{4}$	Fourth.

The highest yield was 24 tons per acre, and the average yield 16 tons 5 cwt. per acre. Appropriate valuable prizes, all of which were donated by the Otago Expansion League, were awarded to the winners.

A display of the activities of agricultural-club work was made at both the Invercargill and Dunedin winter shows. Further, both the agricultural and pastoral associations included in their schedules classes for club members. The club sections never failed to attract the attention of show visitors, and, apart from their educational value, such displays will certainly be the means of winning many new members.

General.

In addition to the prizes already mentioned, donations have been received by the Southland executive from the following: Reginald

MacKinnon Trust Fund, Invercargill; L. Evans, Long Bush; Southland Education Board; R. Dickie, Tuturau; Peter Anderson Trust Fund, Gore; Farmers' Union, Woodlands; and subscriptions from forty adult members.

The movement is now firmly established in the South, and the excellent co-operation existing between competitors, parents, teachers, supervisors, instructors, judges, and the controlling executive has been the means of establishing a strong bond among all concerned.

WOOL RESEARCH IN NEW ZEALAND.

LAST year wool investigatory work was apportioned between the Massey and Canterbury Agricultural Colleges by the Wool Advisory Committee of the Scientific and Industrial Research Council. The progress of the work is summarized in the annual report of the Research Department for 1929-30 as follows:—

(1) In breeding experiments a beginning has been made in the study of the inheritance of wool characters in the New Zealand Romney. These experiments have reference especially to thickened tip, including hairy tip, and to harshness.

(2) One convenient method has been found for obtaining a numerical measure of thickened tip and hairiness. In the course of this work various facts about the wool samples studied were brought out that could hardly have been discovered without counts and measurements.

(3) Experiments with differential shearing have provided a definite case of medullation being influenced by environmental conditions.

(4) A detailed study is in progress of the fibre-types and their development. This is the most fundamental part of the biological work, and should provide the basis for many breeding and other experiments.

During the year, practical liaison was effected with the British Research Association for the Woollen and Worsted Industries, and results of all the investigations conducted by the staff of the association at Torridon and elsewhere will henceforth be available to the Committee. In view of the considerable extent and marked progress of the investigations conducted by this association, this connection is one of much value to local research workers.

Advantage was taken of this arrangement to secure representative samples of Romney fleeces grown throughout New Zealand, and after selection and retention of duplicates these have been forwarded to Torridon for examination and report. The defects in the character of New Zealand Romney wool, as alleged by English manufacturers, have so far proved somewhat elusive and ill defined, and this means of ascertaining the full nature of the defects, and possibly remedial measures, is being resorted to.

It will be to the ultimate advantage of the New Zealand wool industry to supply material of the particular quality required by manufacturers. The facilities offered by the Research Association for the Woollen and Worsted Industries are therefore being availed of, to give indications as to possible improvements desirable in our wool in order to better fit it for spinning purposes.

In order that the investigations at Torridon may be followed closely and the maximum advantages derived from them, and in order to ascertain to what uses Romney wool is being put by English manufacturers, Mr D. J. Sidey, B.Ag., of the staff of Canterbury Agricultural College, has been sent to England.

The Committee, being fully aware of the complexity and of the importance of the wool problem as affecting the Dominion, has decided to follow a cautious policy and to acquire the fullest information on the whole subject before launching a comprehensive scheme of research. The work undertaken so far has therefore necessarily been largely of an exploratory nature.

The Wool Committee consists of Dr. C. J. Reakes (Chairman), Mr. W. Perry, Professor G. S. Peren, Professor R. E. Alexander, Mr. A. H. Cockayne, Mr. E. Short, Dr. F. W. Dry, and Mr. Q. Donald.

SEASONAL NOTES.

THE FARM.

The Pastures.

AT times poor results are obtained from the autumn sowing of pasture-seed mixtures. One of the causes of this is the sowing of the seed too late on in the season ; another is insufficient preparation of the seed-bed. Both of these factors may originate from the same cause—commencing the preparatory cultivation of the seed-bed at too late a date.

The seeds used in pasture mixtures are all relatively small. Generally the most economic means of obtaining the fine tilth in the soil that small seeds call for is to allow plenty of time between the initial cultivation of the land and the sowing of the seed. This enables the influence of aeration to assist in breaking up the soil and the production of the mellow, well-consolidated condition of the soil that it is difficult, if not impossible, to obtain by preparatory cultivation of short duration From this it follows that many of those who contemplate the sowing of pastures in the autumn should soon be attending to the matter of providing suitable seed-beds—seed-beds in which great numbers of the small seeds will not be buried so deeply that they will have but small chance of pushing their shoots up into the light

In the laying-down of permanent pastures, which it is intended shall not be broken up again for as long a period as possible, it is surely desirable to use nothing but the most suitable seed and ample amounts of it, for the influence of any weakness in this respect will probably endure for years. Hence the casual manner in which pasture seeds at times are purchased naturally causes one to wonder. For permanent pastures it may be taken as a rule, with few exceptions, that poor seeds are dear at any price. By poor seeds are meant those unsuited for the purpose for which they are used. Each year pasture seeds poor in strain or poor in germination capacity find purchasers, thereby providing evidence that some farmers at least do not realize the true economy of good seeds even though they be relatively costly.

The matter of quality in pasture seeds should be considered well ahead of the time when the seed is to be sown, in order that there may be ample time for the selection of lines of suitable strain and good germination. Recent research has stressed the fundamental importance of strain, particularly when the best known methods of pasture utilization are to be adopted. By long experience it has been established that the germination-capacity of seeds should be tested, and, in view of this, official testing of farmers' samples is carried out free of charge by the Department of Agriculture. The position is summed up in the fact that hurried purchase of pasture seeds cannot be depended upon to give satisfactory results. An important function of the Fields Division is the tendering of advice, when requested, in regard to the composition of pasture-seed mixtures.

When hay or silage has been saved from a field it will often respond profitably to a dressing of superphosphate, especially if the herbage is mown while still somewhat immature and if the fertilizer is applied as soon as the mown material has been removed. The quick stimulation of growth which can at times be obtained by the use of superphosphate in this manner gives a greater aftermath of fresh feed which is particularly valuable in view of the critical stage at which it becomes available—that is, when supplies of fresh grass are apt to be scant.

Generally care should be taken to avoid the production of seed by recently sown pastures during their first year, and this care is especially necessary if the seed mixtures that have been used were designed for the production of permanent swards and so contained seeds of slow-developing as well as of relatively quick-developing species. If seed production is allowed to take place in the early stages when such mixtures have been used, poor establishment of the valuable slower species may be expected

At times it will prove advantageous to allow areas of thin worn-out grassland to run to seed in the summer, provided the sward on such areas contains reasonable quota of species of which it would be worth while to have reseeding. If this is done the areas should be drastically harrowed in the autumn when the seed has ripened and when rains sufficient to safely establish the seedlings may be expected. Under favourable circumstances this practice may prove valuable as a means towards a denser sole of grass, especially when for some reason ploughing up of a weak turf is either not desirable or not possible. When ploughing and regrassing are practicable they frequently form the most satisfactory means of obtaining improved swards.

Basic Importance of Cultivation.

There is at this season much cultivation work which will require attention. Cultivation is certainly only one of the links in the chain of factors which beget good crops, but the point which must not be overlooked is that if cultivation is the weak link there is only one thing which can be done to increase the strength of the chain. That one thing is to fortify the cultivation link.

Systematic observation has taught that the free use of suitable fertilizer and the sowing of the best possible seed in ample quantities are effective or ineffective according to the efficiency of the cultivation work An obvious and important result of cultivation is the suppression of weeds. Its value in this connection is great, because weeds so readily rob crops of their supplies of moisture and direct sunlight which are essential to growth. Before passing from this aspect it may be remarked that the greatest harm done by weeds is the cutting-off from the crops of their supplies of sunlight. When the supply of direct light is cut off crops cannot satisfactorily feed, even though plant-food may be in the soil in great abundance. A survey of the methods of those farmers who participate in crop competitions throws an interesting light on the value of cultivation in the suppression of weeds These farmers frequently grow mangels or carrots after such crops as mangels, carrots, or potatoes, and obtain splendid yields when they do so. Such a practice could not be adopted with any satisfaction unless the first crop of this type in the series were made a " cleaning crop " in fact as well as in name. Too often the crops which in theory are cleaning crops in reality bring about fouling of the land with weeds. Cultivation is the key to the growing of true cleaning crops.

Weed-suppression is the obvious effect of summer cultivation, but it is only one effect. Other effects, though not so obvious, are at times equally or even more important One of these valuable effects is the hindering of the escape of soil-moisture by evaporation from the surface. When the surface layer is kept loose by cultivation moisture escapes from the soil freely only through the leaves of the crop growing on the soil. Hence summer cultivation if carried out early enough assists in creating reserves of soil moisture which will prove of value during dry periods. This effect of summer cultivation is of particular moment in the extensive portion of New Zealand which is characterized by an annual rainfall of 35 in. or less.

Cultivation is of further value because it brings about soil aeration which sets up changes that make it possible for crops to obtain from the soil certain essential substances which otherwise could not be used by the crop and which would be in short supply.

Summer cultivation is the particular concern of all those farmers who grow mangels, potatoes, carrots, turnips, and swedes, and similar crops grown in rows wide enough apart to allow of intertillage.

Preparatory cultivation, as distinct from intertillage, for crops such as swedes, which are still to be sown will in many instances be calling for attention. If preparatory cultivation is inadequate, then efficiency in other respects will not win the fullest possible reward.

Utilization of Special Summer Feed.

Frequently when special summer feed has been grown to supplement the pastures, a start with the feeding of it is not made early enough in the case of "wet" stock. On many farms from about Christmas onwards the pastures are allowed to become so woody that they no longer, by themselves, provide suitable rations for such stock. Many farmers, however, are deceived by the amount of herbage on the fields into believing that the requirements of the stock are being well met Actually the stemmy pastures are deficient in respect to digestibility and faulty in regard to their balance of nutritive substances, and the only way to provide a really good milk-producing ration is to feed leafy or non-woody herbage by using special crops such as young green lucerne, fresh aftermath of grass, or early sown quickly maturing soft turnips Only by doing this will unduly heavy falling-off in butterfat production be avoided if the pastures have been allowed to become stemmy. In summer poor quality in feed is probably a more frequent cause of undue falling-off in yield than is poor quantity Poor quantity is remedied because it is recognized, poor quality is sometimes allowed to continue to operate because it is not recognized.

In ordinary practice the best summer feed for calves is short, fresh, clean grass which contains a well balanced, highly digestible supply of the nutritive substances required for growth, whereas rank grass-growth is very apt to be badly balanced, and to be deficient in the mineral compounds which are vitally essential for the production of strong constitution and good bodily development. Hence a special effort should be made to arrange for the calves to have the run of short, fresh pasture. Should it be necessary to supplement the pastures by the feeding of roots, it is well to bear in mind that roots are at times deficient in mineral content so far as growing stock are concerned, and that the deficiency in this respect usually can be remedied readily by the feeding of a relatively small portion of bran.

Because of the invasion of weeds, young lucerne may require mowing towards the end of January. It is better not to mow young lucerne so early unless weeds are threatening to outgrow the lucerne plants and to thereby harmfully restrict their supply of light and moisture. If cutting is necessary it should not be done too closely

Unless unusually dry conditions prevail it is usually profitable to top-dress lucerne with superphosphate, at the rate of 2 cwt. to 3 cwt. to the acre, after it has been mown in midsummer. Super applied at this stage will benefit practically nothing except the lucerne, whereas fertilizer applied in the spring may benefit not so much the lucerne as invading plants, such as rye-grass, the suppression of which is most desirable.

If soft turnips are being carted out to stock it is usually desirable to scatter them well over the field in which they are being fed, so that droppings will be evenly deposited ; but if the fertility of a particular area requires building up, then it will probably be well to concentrate the feeding-out of the roots on that area.

Often the earlier sown rape crops will be ready for feeding off in January. It is usual to feed off the crop in small blocks. Lambs on rape should have a good run-off on pasture, and when the feeding of the rape is being commenced they should be allowed on it only for a short time.

In order to obtain the best return from millet, feeding of it should start when the crop is 6 in. to 8 in. high. When it is fed at this stage of development it will subsequently stool out and give a valuable second growth.

Forage-crop Considerations.

Often in January it is possible to estimate whether an adequate supply of forage for the winter and early spring is in sight, and if it is decided that the supply is likely to be insufficient there is still time to increase the provision. One may grow a late summer or early autumn sown temporary pasture with 20 lb. of Italian or Western Wolths rye-grass and 4 lb. or 5 lb. of red clover, to the acre This must be sown early to make certain that it will yield a substantial supply of winter feed, and it can be counted upon under average circumstances to yield a heavy hay or silage crop in the following season When the land available for emergency winter-feed production will be required for spring sowing, then instead of a temporary pasture Algerian oats or black skinless barley should be sown ; both require about 2½ bushels of seed per acre. Often the fullest possible return from autumn-sown temporary pastures or cereals for green feed is not obtained because sowing is not done early enough. This is especially the case in the South Island.

If turnips and swedes have not been sown by New Year, this should be done at the earliest opportunity , Hardy and Imperial Green Globe are turnips suitable for January sowing. In most places after the middle of January it is safer to sow turnips rather than swedes, because the turnips develop more quickly and do not suffer so severely as swedes from the summer and autumn ravages of insect pests. Both turnips and swedes will usually respond profitably to a fertilizer dressing at the rate of 2 cwt. to 3 cwt. per acre. In such a dressing superphosphate should be prominent, and often bonedust can be profitably included The autumn-sown cereals and temporary pasture can be depended upon to respond profitably to a dressing of 2 cwt. or 3 cwt. per acre of super.

Thinning of such crops as mangels and carrots should be pushed on if this has not already been given attention, and if the seedlings are pale and leave the impression that they have had a setback they will probably respond profitably to a dressing of about 1 cwt. per acre of nitrate of soda scattered along the rows close to the plants and hoed in after thinning has been completed.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Maintenance of Spray Controls.

THE main and most important operation in the orchard during the coming month will be that of sound and consistent spraying, in order to maintain controls against diseases and pests on fruit and trees. Codlin moth will again be on the wing in large numbers, so that it becomes imperative to keep the fruit completely covered with a film of lead arsenate.

It is suggested that summer dilutions of emulsified oil combined with Black Leaf 40 may with advantage be experimented with on a limited scale for control of codlin moth, red mite, and bronze beetle. It is reasonable to expect that this solution may act as a deterrent to moths depositing eggs, or even destroy eggs already deposited, thereby eliminating a certain proportion of the stung apples which are often found even when arsenate of lead has been thoroughly applied. The effect of the spray as a control of bronze-beetle and red-mite should also be beneficial. The most susceptible period for black-spot may be regarded as over after New Year,

enabling the grower to extend the period between applications; but this extension should not be practised unless dry weather prevails.

During the dry summer months heavy dews at night are often experienced, a form of moisture which is probably more conducive to the germination of fungus spores on fruit and foliage than rain, which has the action of circulating or entirely removing the spores from where they may be lodged. The danger from moisture in the form of dew particularly applies to the late summer, when the pin-spot form of black-spot of apple and pear is so often in evidence. The easing-up of the lime-sulphur programme is also a factor which enables red-mite to increase to a marked degree during January and February. In this case special preventive measures should be taken by the application of sprays as recommended in last month's notes.

Thinning.

This operation should soon be completed. In the case of apples it is recommended that the removal of the centre or crown fruit should commence the process, in order to relieve the pressure on the surrounding apples, especially with short stalked varieties, and also to open up the clusters to facilitate the penetration of spray solutions. This method of thinning will largely prevent the seclusion sought by bronze-beetle and leaf-roller caterpillar in the clusters of fruit. Subsequent thinning should be mainly directed towards the removal of fruit which is diseased or otherwise defective for marketing.

Cultivation.

General cultivation of the orchard for conservation of moisture should be continued not only to supply the moisture demanded by the tree for maintenance of growth, but also so that the manure which has been incorporated with the soil may function to the maximum extent. The relation existing between the action of artificial fertilizers and soil-moisture is often not fully appreciated or understood by orchardists.

Growth of long grass and weeds immediately under the trees which have not been removed by power or horse implements should be dislodged by hand tools and dragged towards the centre of the rows, to be killed by exposure to the sun and in the process of general cultivation. The destruction of undesirable growth under the trees also removes the egg and larva stage of the bronze-beetle, exposes fungus spores to the destructive action of light and dry winds, and removes material in which codlin moth may pupate for the following season.

Preparations for Export.

Special efforts should be made during the coming month to complete the arrangements for export Case-making should be finished, and quantities of packing material checked against requirements for the prospective crop (which should not be difficult to estimate at this period), in order to avoid the inconvenience and vexation caused by shortages of material when shipment is in progress.

—*M. Davey, Orchard Instructor, Mapua.*

Citrus Culture.

Cultivation: Every opportunity should be taken to carry on with this work. Should conditions become dry the citrus trees would very soon suffer through lack of moisture. At this period of the year trees are producing their maximum growth; moreover, as the fruit is setting and developing, every assistance should be given to the trees. Where a fine tilth has been provided all moisture will be conserved, and this will assist the trees to give the maximum results Fruit development and wood-production places considerable strain upon the resources of the trees,

and nothing should be left undone that will assist them to function in a proper manner. The failure of so many trees to return anything like a reasonable return is because correct and proper attention has not always been given to them

Manuring: A study should be made of individual trees, their habits and their needs, and treatment given accordingly This applies particularly to any feeding that is required At this period of the year, when the young fruit is placing extra strain upon the trees, a little assistance should be given in the way of sulphate of ammonia—say, 2 lb per tree.

Young planted trees: Any check received by the young tree in the first season is often reflected for a number of years. It may be that there are superfluous young shoots that require to be either rubbed off altogether or pinched back This should not be neglected However, it may be possible to err in the direction of pinching too much during the first year. Discretion should be used, and every encouragement given for the trees to produce a reasonable amount of wood growth upon which can be built a strong and vigorous tree that will in time produce regular crops of fruit

—*L. Paynter, Orchard Instructor, Auckland*

POULTRY-KEEPING.

Preparing the Cockerels for Market.

ALTHOUGH hatching is now over for the season, and the bulk of the chickens have passed the real danger period, next month will prove to be a busy time for the poultry-keeper from the fact that the maximum amount of stock the plant can carry will be on hand. In addition to this the young birds are rapidly developing and are daily making greater demands on the accommodation available; further, hot trying weather may be experienced.

In view of these circumstances good and careful management, particularly in regard to the growing birds, is imperative if they are to avoid receiving a set-back. Overcrowding should be prevented at all costs. To lessen the risk of this and its evil effects, the weeding-out of every bird that is not likely to show a profit over its keep is a matter which the poultry-keeper cannot afford to ignore. Particularly is this the case with cockerels, for unless these are marketed when they reach an age of four and a half to five months they may easily show a loss instead of a profit. The birds should be made to rapidly lay on flesh by good feeding and management, and be in a prime condition at the age mentioned. The fact should not be forgotten that it costs less to produce a pound of flesh than a pound of frame, and that it will pay to prime poultry just as it pays to prime other classes of live-stock.

When a cockerel reaches an age of between four and five months it commences to grow its adult feathers, and obviously it cannot be expected to produce these and put on flesh at the same time. Even under the most careful and effective management the margin of profit from cockerels is small, but if kept until the chicken stage has passed or later the profit will be reduced accordingly. Clearly the consumption of food will be increased, due to the greater growth of plumage, bone, &c., necessary for the development of an adult bird; but this is not the only drawback, for even if a fully developed cockerel is marketed in an absolutely prime condition it does not appeal to the poulterer, to whom it is known as a "stag." The fact of its having a well-grown, sharp spur reduces its value as a table bird. Generally such a bird is coarser and larger than is desired for the high-class trade—in fact, it is usually classed as a boiling-fowl.

A weakness on many plants in developing the market cockerel lies in providing it with only a bare living diet, or with a mash chiefly made up of greenstuff, boiled potatoes, &c. As a means of reducing the cost of production these cheap foodstuffs may be sparingly included in the ration, but the best results cannot be obtained unless the greater bulk of the ration consists of wholesome grain material The following mash and other feeding is recommended after the priming process has commenced: Equal parts by measure of wheat-meal, maize-meal, and bran, the whole being moistened with milk or soup, and mixed into a crumbly mass Feed three times a day all that the birds will clean up Green food should be fed separately during the day Where milk is available this should be given in large quantities to drink.

Pale Yolks and Blood Spots.

A poultry-keeper advises me that for some time past he had disposed of his surplus eggs to a private customer well in advance of current prices, but lost these sales owing to the yolks being more or less pale in colour, while some of the eggs contained blood spots. It was considered by the purchaser that this condition of the eggs was an indication that the fowls which produced them were affected with disease. The fact of a bird laying such eggs, however, does not necessarily indicate that it is affected with any form of disease. In the first place an odd egg containing a blood spot may be produced on the best managed of plants and when the stock are in a healthy thriving state. It must, however, be admitted that blood spots are much more frequently produced where the birds are being forced for egg-production by means of rich food such as meat, meat-meal, condiments, &c.

Blood spots or clots in eggs are generally due to a rupture of a small blood-vessel near the ovaries in the envelope enclosing the ripe yolk, or in the upper part of the egg duct. With white-shelled eggs blood spots, however small, can be easily detected by testing before a light, when a deep red colour will be noticed. With brown-shelled eggs a blood spot is not so easily detected, as the shell colour, even in a normal egg, causes its content to appear more or less red when under the testing process. Where it is discovered by testing that eggs with blood spots are being produced the birds which produced them should be located by means of trap-nests and then disposed of.

Yolk colour is largely influenced by the food supplied to the birds. The inclusion in the ration of yellow maize, lucerne, clover, carrots, watercress, meat, or milk will tend to produce rich-coloured yolks Reference is now made to those cases in which the birds are being kept under confined conditions, as it is well known that eggs containing pale yolks are seldom or never produced where birds are provided with a free range and natural conditions generally. It is unfortunate that the case in point is only one of many where the sickly appearance of the yolks of eggs from birds confined in a yard, without any vegetable matter and animal food, has discouraged the use of eggs and consequently reduced the demand for this product. Obviously such conditions will continue until the market value of eggs is fixed according to quality, including colour of yolk and size of air-cell (this latter being an indication of age), rather than on the doubtful lines now obtaining on the markets.

What applies to egg quality applies in like degree to their size, as the demand is not likely to be increased if the top price is demanded for an egg weighing about $1\frac{7}{8}$ oz. or less, which is commonly the case at present. If the necessary reforms are to be brought about in this direction the consumer has his part to play. In the first place he should demand eggs of undoubted quality, and, secondly, that they be uniform in size and be sold according to their weight per dozen. Just as purchase by weight is bound

to come, so will quality enter into the market value of eggs. Only then will the producer be encouraged to place in the hands of the consumer tested eggs of uniform size, branded as a guarantee of quality; while in turn the consumer will be induced to eat more eggs and likewise pay the full market value for the superior article.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Control over Breeding.

ONE of the most important factors in the successful practice of modern apiculture is securing control over the breeding, and this can be obtained by compelling the bees to build whatever comb is desired.

Under natural conditions, or when in hives and allowed freedom to construct combs, bees invariably build a large proportion of drone-comb, which is subsequently utilized for breeding drones Some drones are needed for the impregnation of young queens, and usually a sufficient number for the purpose will be bred even when the breeding of them is restricted by making the fullest use of worker comb-foundation. The comb-foundation obtained from manufacturers is impressed with the bases of worker-cells, and by the use of full sheets good worker-combs are usually obtained. However, accidents may happen to the combs, portions of the foundation may break away under the weight of a good swarm, and other portions sag and stretch, owing to the comb-foundation being carelessly fixed In such circumstances the bees will quickly build drone-comb, and thus destroy the purpose for which the foundation was originally designed.

The replacement of such combs is a matter of urgency, otherwise countless drones will be raised and the toll on the stores gathered by the workers will result in the ultimate returns from the hive being considerably curtailed. The beginner will be loath to remove the combs containing drone-cells, on account of the presence of worker-brood To reduce the number of drones being reared he will be tempted to bring into use drone-traps, which hamper the access of the worker-bees to the hives, or he may elect to destroy the cappings on the cells. Such measures are ill advised, and cannot be counted upon to successfully remedy the drone trouble The most effective way to prevent the rearing of drones is to remove the combs containing the drone-cells This may be accomplished by removing the combs from the centre of the brood-nest to the side of the hive, or by placing them in a super over an excluder. When the worker-brood has hatched the combs should be removed altogether.

After-swarms.

The beekeeper should give some little attention to the prevention of after-swarms. These swarms are a nuisance, and weaken the parent hive without being of much value in themselves. If the colonies are left undisturbed they will swarm freely, and all chance of a surplus is lost.

Among the many plans practised for their control the most successful is that which provides for removing the parent hive This method is an excellent one, and will usually prevent the issue of the small swarms. As soon as the swarm is hived the parent hive should be removed to a new location in the apiary, and put the swarm on the old stand. The effect of this change is to strengthen the swarm with the field bees which are absent gathering nectar, and correspondingly to temporarily weaken the old hive, so that it will rarely put out a second swarm. The emerging bees in the parent colony will soon provide sufficient workers to ensure a

surplus, and the tendency to swarm will not be so prevalent In order to make the operation more successful the parent colony should be examined for queen-cells, and they should all be removed save two.

After-swarms should always be returned to the parent colony unless they are required for increase. In the latter case it is a good plan to dump two or three swarms together, and thus form a strong colony that will gather sufficient stores to carry on through the winter In dumping shake the swarms on to an excluder placed between the supers, so as to take out the young queens Before returning an after-swarm overhaul the parent hive and cut out all the queen-cells. Place two or three empty combs or frames fitted with sheets of foundation in the brood-chamber, and put the brood over an excluder to hatch out In case the colony contains a virgin queen the combs, before being placed over the excluder, should be shaken in front of the hive to make sure that the virgin queen is not confined above the excluder, or she will not get mated, and a drone-raising colony will be the result. A good plan at all times is to provide an opening for the bees between the super and the brood-chamber, which can be done by inserting a small block of wood immediately under the edge of the super. This will allow the bees to fly freely, and in case the virgin queen is by accident confined to the super an opportunity will be given her to fly and get mated. Likewise the drones can pass out of the super. If on making a later examination the queen is discovered in the super, she can be placed in the brood-chamber under the excluder.

Foul-brood.

As advised last month, beekeepers should not fail to treat diseased colonies where found. This work should be carried out in advance of the main flow, so that undivided attention may be given to securing a crop. Over and over again the treatment of disease is delayed until such time as the season is advanced, and as a result the affected colonies do not count as producers in the main crop; whereas if treatment is carried out as soon as nectar is being freely secreted these colonies will be in good heart to produce a surplus When in doubt as to the presence of disease it is advisable to forward a sample of the comb addressed to the Director of the Horticulture Division, Wellington, or to the district Apiary Instructor, for examination.

Queen-excluders.

The season is at hand when it is advantageous to use queen-excluders. During the height of brood-rearing, and in order not to cramp the queen, she should be allowed the full use of the super, so that large numbers of worker-bees may be raised to work the main crop. It is not wise to bring the excluders into use too early, and never until such time as the bees are working freely in the super. By cramping the queen fewer bees are produced, and small returns will be netted. Every encouragement must be given the queen to lay to her utmost, and by so doing populous colonies will be produced.

The best time to put the excluders on the hives is when the main flow sets in and the bees are busy bringing in nectar. Too many beekeepers make the mistake of putting on the excluders when the supers are first placed on the hives, and it is not an easy matter to get the bees to work in the supers even if combs of honey are raised from the brood-chamber, as excluders tend to make the passage between the lower story and the upper more difficult. Before placing the excluders make a careful examination of the colony to note its condition, and to take stock of the number of frames of brood in the hive. If the brood-chamber is full of brood the combs may be manipulated so as to provide the queen with ample room for laying during the period which follows. The best plan is to place the majority of frames of capped brood over the excluder, and to substitute

empty combs, taking care to see that the queen is confined below. As the bees hatch out over the excluder they will become accustomed to passing through it, and as fast as the cells become vacant they will be filled with honey If eggs are raised with the brood care must be taken to see that the bees do not raise queen-cells, for in the latter case the hive may swarm out, leaving one or more virgins in the top story, and these queens, being confined to the hive, cannot get out to be mated, and will eventually develop into drone-layers. Within one week after raising the brood examine the combs in the super to note if any queen-cells have been raised. If any are found they must be destroyed.

The advantage of the use of queen-excluders is in saving labour at the time of extracting, by doing away with the work of picking over the combs. Much time is lost in this operation, and extracting is retarded when everything should be hurried. It is only by the use of excluders that bee-escapes can be employed, and in many seasons, depending largely on the weather, these have to be brought into use.

Treatment of Swarms—Provision of Supers.

There is a little doubt in the minds of many beekeepers who have been accustomed to box hives as to the surplus to be obtained from a swarm. It is not uncommon to find swarms put into frame hives and not provided with room for surplus. Unless supers are given to strong early swarms from ten to fifteen days after they are established these colonies will often swarm again, and no surplus will be obtained. It must be understood that the season plays an important part in the returns netted, but large amounts are yearly lost through the beekeeper neglecting to give ample room for the swarm to store honey.

When a swarm has been established a few days a quick examination should be made to note progress, and from this the beekeeper will be able to form some idea as to the time at which the super will be required. Nothing works so well as a swarm under proper treatment, and the attention given in providing supers will amply repay the beekeeper.

Queen-rearing.

In last month's notes attention was directed to queen-rearing. Every effort should be made to requeen the apiary during the working season, so that the colonies will go into winter quarters headed by a good queen. It often happens that the beekeeper is dissatisfied with his stock, in which case his best plan is to send direct to some reliable breeder and secure a number of good queens Whether this suggestion is carried out or not, when raising queens the beekeeper should select the best stocks in his apiary; in other words, queens should be raised from queens whose bees have a record as honey-producers.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

The Tomato Crops.

THE crop under glass is now being harvested, and owing to the late development of the outdoor crop the demand should be well maintained. Where heat is available, and the pot system of growing the plants is adopted, a fresh crop is now started so as to be ready to take the place of the present crop, which will finish about the month of February. For this work under glass nothing is more important than a good strain of seed, and every care should be taken to get it. When it is obtained a four or five years' supply of seed may be harvested, as its vitality can be relied upon for that period.

Reference was made last month to progress in equipping the heated glasshouse; the progress in economical and efficient management is very marked. A report is now to hand from Hamburg, Germany, that experiments have been carried out in heating these houses with hot air instead of hot water One of the oldest systems of heating was by means of flues passing through the house, and thus raising the atmospheric temperature by means of the heat given off from the surface of the flue. One of the most modern is to plug in a number of small electric heaters, a method that is useful to meet the exigencies of a cold snap. The experiment referred to is an application of a heating principle, long in use in Central Europe, but one that has been extended and adapted to meet modern requirements. The principle is to create a draught over the surface of a hot stove and deliver the heated air through ducts to the places required. Stove-heating has been popular in dwellings in cold climates, but the heat has been badly distributed. By the new method the vicinity of the stove is no warmer than the more distant parts of the chamber, as the heated air is drawn off the surface of the hot iron as soon as it is created.

This equipment consists of a wrought-iron stove enclosed in an outer metal covering. Cold air is drawn in below between the stove and the cover, heated, and then drawn off the top and liberated through the glasshouse by means of ducts and an electric fan. The large Hamburg establishment where the system was installed found that tomatoes ripened earlier than in houses where the hot-water system was in use. The simplicity of the system makes it attractive, and the results obtained are encouraging. Perhaps some one with the pioneering spirit may care to try it.

The crop of tomatoes grown outside commences to ripen towards the end of January. It will be interesting to see the decisions put into operation for a measure of standard packing as passed by the last conference of growers. If this progressive movement is general it will be a great contribution to an orderly method of marketing, which is so indispensable when perishable goods have to be boxed and shipped to a distant market.

Small Fruits.

As the crops are gathered summer pruning should be completed. Strawberry beds should be cleaned up and manured ready to take advantage of the autumn growing period to build up the constitution of the plants for a good crop next summer

In the case of raspberries and loganberries it is specially desirable to cut out the cropping canes as soon as the crop is gathered, and to burn them. This is the most effective contribution to the control of pests and diseases in these crops. It also facilitates the ripening of the young canes for the next season's cropping, and the application now of such sprays as may be required.

Market Garden Crops.

The early potato crop is now being lifted, but crops of the later varieties will not ripen for another three or four months. The fungus disease known as "late-blight" (*Phytophthora infestans*) usually commences to make its appearance at this time, and is the cause of considerable anxiety to growers of late crops in the wetter districts or during a wet season. Under such circumstances a bordeaux spray should now be applied. The usual strength is the 4–4–40 formula — 4 lb. bluestone, 4 lb. rock lime (quicklime), and 40 gallons water. There are some important points about making this mixture, some of which are as follows: Dissolve the bluestone in a wooden or earthenware vessel, as it corrodes most metals and is spoiled by some. Dilute the ingredients before mixing them; the materials then easily remain in suspension, and the mixture is strongly adhesive and thus

protects the plants for the maximum period. Wrongly mixed a coarse precipitate is formed, which is difficult to keep in suspension and the mixture has poor adhesion. These are some of the reasons for being particular. The right way is just as easy and quick as the wrong way, and has at least twice the efficiency. Another point is that the spray should be used the same day as it is mixed, because it loses adhesion with keeping. Five pounds of washing-soda may be used in the place of 4 lb of quicklime. The application should be repeated after two or three weeks and continued as may be necessary Sometimes the solid ingredients are increased after the first application, as much as 5 lb or 6 lb each of bluestone and lime being used

If the grower is lifting a clean crop of early potatoes that are true to name, seed should be selected from them ; the opportunity is too good to miss If the crop has been patchy or diseased it is best passed over for seed The virus diseases that may be infecting the tubers cannot be observed at this stage

Last month's market garden notes have now a special application in the warmer areas. The very important crop of spring cabbage maturing about the month of September should be sown about the middle of January in the coldest parts of the country In other districts it is deferred for a month.

The Homestead Garden.

Smooth lawns and smart well-trimmed hedges look well in the vicinity of the dwelling Hedges will now require attention , this feature is by no means the easiest to maintain, and a great deal of consideration is necessary to keep them looking well The tendency is to allow hedges to bulge, especially at the top, where they become wide with branches thickly interlaced, the base being bare or scantily clothed with foliage. Most hedges should now be trimmed, and in doing this the sides should be made to lean together in a wedge shape as far as possible. This develops a narrow top and broader base, which looks well and provides shelter and protection where it is required—low down.

Climbing plants, with all their varied habits, and trees and shrubs trained as espaliers, require careful training and summer pruning at this time. Chiefly this is done to check vigorous growth in directions where it is not required. To do this the tip of the growing shoot is pinched out or superfluous shoots are rubbed off altogether. Careful manipulation of this kind during the growing season is the method of controlling a number of kinds of vines and climbers. New growth that is to be encouraged should be carefully tied in. Rambler roses after flowering should have the old wood cut away at the surface of the ground, and as much of the young growth as may be required carefully secured. If young wood is scarce canes may be flowered the second season by shortening the laterals in the spring.

—*W. C. Hyde, Horticulturist, Wellington.*

Water Content of Export Butter—During the year ended 31st March last 156,967 churnings of butter were tested by the Dairy Division for water content, the average percentage of water being 15·32, as compared with 15·29 for the previous year Churnings over the legal limit of 16 per cent amounted to 0·5 per cent., and these were returned to the respective factories to be reworked with drier butter.

Analyses of Sodium Chlorate in Different Forms.—Some supplies of sodium chlorate have arrived in New Zealand in the crystal state and others in powder form. Samples analysed for the Fields Division gave the following results as regards purity: Crystals, 99·8 per cent., powder, 98·5 per cent. The balance in each case was ordinary chloride.

REVIEW.

The Soils of Irrigation Areas in Otago Central: Bulletin 33 (New Series), New Zealand Geological Survey, by H. T. Ferrar. Government Printer, Wellington, 1929. Price—paper cover, 10s.; quarter cloth, 12s. 6d.

UNTIL fairly recently soil surveys have received little attention in New Zealand, despite the almost universal acknowledgment that a properly conducted survey of soil types is of great assistance not only to the geologist, but to the agriculturist, forming, as it does, a basis for the economic utilization of the lands under survey. Mr. Ferrar's work is therefore all the more appreciated, and the bulletin under review may be summed up as a valuable contribution to the literature dealing with this semi-arid region of New Zealand.

The mapping of some 1,177 square miles of the irrigable area of Central Otago has been admirably executed. The publication is the result of nearly three seasons' work, and contains forty-two pages of letterpress, illustrated by a number of photographic plates, together with a key map and sixteen soil maps The maps evince scrupulous care in compilation, and possess a wealth of detail which reflects the greatest credit on their compilers. The soil-classification falls into five well-marked series containing one or more of the several classes, such as clay, silty loam, sandy loam, sand, and gravel, which are subdivided into soil types according to situation with respect to facilities for irrigation and drainage. The classification has been carried out on broad and simple lines, and the soil types have been adequately described in the text accompanying the maps.

The bulletin deals with many aspects of Central Otago, including a discussion on irrigation problems and a description of the district in general, with its fauna and flora. A few minor discrepancies have been noted in regard to the latter, particularly the statement that "around Arrowtown ragwort (*Senecio jacobaea*) covers large areas and has become a noxious weed." In point of fact, no ragwort exists in the district, obviously St. John's wort (*Hypericum perforatum*) being meant

Dealing with the subject of "Irrigation Problems," the author in small compass endeavours to summarize and advise on some of the chief problems relating to irrigated agriculture, and here a few points seem to call for comment. Particulars are given in regard to the water requirements of the Great Basin region of America, but definite figures relating to Central Otago would have been valuable and could have been readily obtained. Again, few well acquainted with the former and now-existent conditions of Ida Valley will agree with the author's statement that this area is not becoming waterlogged, and that the intrusion of rushes is not to be regarded as of great moment in that they afford shelter for sheep in winter.

It is gratifying to find that the author has investigated the question of "alkali" soils, and his conclusion that "in Central Otago alkaline salts exist in the soil, but not in amounts great enough immediately to endanger the irrigation projects," is heartening. However, the insidious nature of alkali accumulations, which have been responsible for the ruination of many irrigation schemes in other parts of the world, will require careful watching in Central Otago.

In regard to the purpose of the survey the author makes some rather wide claims for such work. When it is stated that "a soil survey, therefore, seeks to differentiate classes of land according to some factor that has a preponderating influence upon crop-production, and to record upon a map the areas occupied by each class, in order that production may be increased in the most economical way," the impression is left that the growing of crops successfully is purely dependent upon soil type. Soil

type, however, is only one factor in successful crop-raising, and within general soil-types exist great variations which cannot be recorded and yet which have considerable effect upon the growing of crops. Again, the remark that "the purpose of the soil survey of irrigation areas in Otago Central is to supply maps that indicate how irrigation water can best be distributed over the land, or removed if drainage is necessary, and at the same time supply information with regard to the special problems from irrigation," cannot be altogether accepted. It must be added, however, that the author remarks: "This survey is not a final investigation. It does not show what areas will best repay irrigation and what quantities of water will be required."

In conclusion, it may be remarked that the principal object of the work—namely, a survey of the soils of the irrigation areas of Central Otago—has been well and faithfully carried out, and the bulletin is commended to all students of soil problems.

R. B. T.

CROP AREAS AND YIELDS, SEASONS 1928-29 AND 1929-30.

Crop.	1928–29		1929–30.	
	Area	Average Yield per Acre.	Area.	Average Yield per Acre.
	Acres.		Acres	
Wheat—				
Grain	255,312	34·60 bushels	235,942	30·68 bushels.
Chaff, &c.	1,272	1·79 tons	1,491	1·29 tons.
Oats—				
Grain	73,101	41·93 bushels	67,722	44·33 bushels.
Chaff, &c.	194,638	1·71 tons	190,072	1·65 tons.
Barley—				
Grain	19,500	40·06 bushels	18,229	41·42 bushels.
Chaff, &c.	340	2·27 tons	402	2·05 tons.
Maize—				
Grain	8,986	50·78 bushels	7,957	47·50 bushels.
Ensilage	295	3·59 tons	695	3·75 tons.
Peas (for threshing) ..	17,893	29·48 bushels	9,855	29·86 bushels.
Beans (for threshing) ..	170	25·29 bushels	171	21·13 bushels.
Linseed (for threshing)	2,800	8·30 cwt.	7,757	9·07 cwt.
Rye-grass seed—				
Perennial	21,536	415·50 lb.	24,366	407·74 lb.
Western Wolths and Italian	4,807	487·22 lb.	5,719	507·71 lb.
Cocksfoot seed ..	11,255	182·04 lb.	11,729	171·37 lb.
Chewings fescue seed ..	9,506	286·46 lb.	9,808	246·37 lb.
Crested dogstail seed ..	5,702	223·92 lb.	3,404	243·51 lb.
Red clover and cow-grass seed	9,750	197·60 lb.	4,703	221·14 lb.
White clover seed ..	3,338	169·68 lb.	3,710	163·04 lb.
Other grass and clover seeds	2,123	114·93 lb.	3,446	91·01 lb.
Grass and clover hay ..	320,299	1·92 tons	380,898	2·12 tons.
Lucerne hay.. ..	30,808	2·62 tons	31,690	2·57 tons.
Potatoes	21,304	5·77 tons	23,214	5·60 tons.
Green fodder crops ..	219,088	..	203,438	..
Turnips	479,994	..	475,254	..
Mangolds	9,914	..	10,519	..
Onions	880	12·07 tons	870	11·80 tons.
Hops	608	1,274·24 lb.	598	1,409·46 lb.
Tobacco*	1,000	..	1,073	..

* Outside borough boundaries.

CERTIFICATION OF PERENNIAL RYE-GRASS.

GROWERS OF CERTIFIED MOTHER SEED.

As a result of trials on the produce of the 1929–30 perennial rye-grass harvest, the following growers are recorded as having areas deemed fit for the production of Certified Mother Seed :—

Name.	Address.	Area.
Hawke's Bay.		Acres.
Allen, A. W.	Tomoana	42½
Allen, J. L.	Raupare	30
Anderson, F. W.	Twyford	4½
Asch, W. Van	Tuki Tuki	62
Bridgman, J.	Mahora	35
Bridgman, T.	Mahora	10
Bridgman, S. G.	Haumoana	16
Britten, Mrs	Pukahu	4
Burge, H. J.	Twyford	4
Burge, H. W.	Twyford	5
Burgess, T.	Meeanee	69
Burns, H. H.	Twyford	73
Burns, W. F. M.	Richmond Road, Hastings	12
Clarke, H. H. R.	Waiohika	25
Couper, E. D.	Maungateretere	40
Crawford, H.	Havelock North	10
Currie, T., sen	Twyford	13
Elliot, D. H.	Haumoana	34
Emmerson, T.	Raureka	8½
Fernie, D.	Pakowhai	90
Frogley, R.	Maungateretere	20
Frost, G.	Twyford	11
Gimblett, W. J.	Ngatarawa	7
Gregory, R.	Clive	12
Griffiths, R.	Twyford	23
Haldane, C.	Raureka	48
Harris, J. H.	Hastings	9
Harris, J. H.	Haumoana	30
Heeney, Mrs.	Mahora	31½
Heynes, W.	Clive	18
Hickson, A.	Fernhill	14
Hill, A. E.	Mahora	11
Hope, J.	Omahu Road, Hastings	11
Hunter, J. G.	Haumoana	8
Lascelles, P. W.	Maungateretere	37½
MacDonald, James	Meeanee	124
McDonald Bros.	Havelock North	10
MacNamara, D.	Pakowhai Road, Hastings	2
Masters, A. J.	Twyford	41½
McLean, A. (Estate)	Twyford	41
McLeod, H.	Hastings	53
McLeod, W.	Pakipaki	8
McNab, J. A., jun.	Twyford	5
McNab, J., sen.	Twyford	13
Merrit, —	Pakowhai Road, Hastings	15
Millar, Max	Pakowhai	14
Milne, C. W.	Maungateretere	4
Moore, R. H.	Waerengaahika	6
Otene, Taha	Tomoana	23
Parsons, P.	Meeanee	48
Percival, T. S.	Mahora	34
Person, Mrs	Hills Road, Fernhill	6
Pickering and Hackett	Waiohika	10
Ramsey Bros.	Haumoana	14
Robertson, J.	Haumoana	26½
Rosser, C.	Pakipaki	97
Rule and Wilkins	Raupare	19
Simson, E. M.	Tomoana	70
Sissons, W. H.	Longlands	12
Smith, A. H.	Poukawa	17
Smith, E.	Twyford	30
Speers, A.	Longlands	12½
Speers, G. J.	Pakipaki	10
Stead, W. G.	Flaxmere, Raupare	22
Stewart, H. N.	Haumoana	71
Struthers, A.	Longlands	25
Struthers, J.	Pukahu	35
Symes, A. F. M.	Longlands	75
Tait, T.	Twyford	15
Tattersall, C. E.	Pakowhai	69
Taylor, W.	Pukahu	8
Thomson, H.	Pakipaki	16
Thompson, J. B.	Mahora	21
Thompson, J. B.	Karamu	10
Todd, R. H.	Otane	40
Wake, A. E.	Pukahu	5
Wall and McLeod	Tomoana	40
Wall, W. J.	Karamu	7
Wall, H. H.	Manutuke	9
Wellwood, R. A.	Mahora South	22
Wright and Wallace	Hastings	8
Poverty Bay.		
Baird, Wm.	Waerengaahika	22
Baird, Wm.	Bushmere	94
Bolton, V. S.	Waerengaahika	30
Bryson, M.	Patutahi	22¾
Doulton, J. E.	Manutuke	9
Fisken, R. C.	Matawera	20
Gray's Estate	Hexton	14
Habgood, F.	Patutahi	25
Hamon, Mrs. H.	Waerengaahika	28
Jones, T. R.	Ormond	9
Lawless, D.	Manutuki	12
Mullan, B.	Waerengaahika	5
Mullan, B. P.	Waerengaahika	10
Roach, J.	Makauri	8
Scott, Mrs. C.	Makauri	6
Sheriff, A. E.	Ormond	13
Taylor, J.	Ormond	15
Turnbull, A. J.	Makauri	10
Witters, G.	Matawera	25

—*J. W. Hadfield, Agronomist, Plant Research Station.*

Cidermaking.—The annual production of cider in the Dominion (reports the Horticulture Division) stands at approximately 50,000 gallons, of an estimated value of £12,500. The bulk of the cider produced is of first-class quality, and finds a ready market. This industry offers considerable room for further extension on a profitable basis, especially in the main commercial fruitgrowing districts.

WEATHER RECORDS: NOVEMBER, 1930.

Dominion Meteorological Office.

GENERAL NOTES.

FOR the third month in succession, for the Dominion as a whole, the weather in November was the coldest experienced since the taking of records commenced It was also very stormy, westerly or south-westerly gales being of frequent occurrence Thunder and hail storms were rather numerous also In consequence of the adverse conditions the season is relatively even more backward than at the end of October. Growth of vegetation generally has been poor. All crops are reported to be in a backward state, and the prospects for the hay crop in particular are in most districts the reverse of bright. The cutting of ensilage has commenced in parts of Auckland Province where the growth of feed has been fair. Stock appear to be in fair condition generally, but there have been some losses of sheep, principally in connection with shearing.

Rainfall.—The rainfall, generally speaking, was above or below average, according to whether or not the district concerned normally receives most of its rainfall in westerly weather In the eastern portions of Wellington Province, in Hawke's Bay, and in most of Auckland there was considerable deficit On the north-west side of the East Cape Peninsula, between East Cape and Opotiki, some places had an excess South of Auckland, about as far inland as the Waikato River, the rainfall was in general considerably above the average. The same is true, also, as regards Taranaki and Western Wellington, the area of heavy rainfall extending beyond the main range into the western parts of the Wairarapa In the South Island a wet month was experienced on all the West Coast and in Otago. In Canterbury and Marlborough conditions varied, some parts having more and some less than the average, the drier parts tending on the whole to have a deficit.

Temperature.—The mean temperature was the lowest recorded for November at Waihi, Tauranga, Hamilton, New Plymouth, Wellington, Christchurch, and Waimate. At Auckland, Napier, Nelson, and Dunedin, though the month was cold, lower temperatures have been recorded previously There were no days of exceptional severity, but numbers that were very cold and none that were very warm Several frosts occurred, those of the 24th and 28th being the heaviest. The latter did considerable damage to small crops in Wairarapa and Hawke's Bay. There were further falls of snow on the ranges, that of the 23rd extending to fairly low levels.

Storms and Pressure Systems.—Until the 27th westerly weather prevailed, and between the 9th and 26th the type was very pronounced. This is a feature common in spring, but which has been less conspicuous than usual during recent years. V-shaped depressions advanced from the west at frequent intervals. The passage of the trough or line of lowest pressure was generally accompanied by squally southerly changes, of which the most pronounced occurred on the 6th, 8th, 13th, 15th, 19th or 20th, 23rd, and 26th. The depressions which passed on the 13th, 15th, 19th, 23rd, and 26th were all deep, and each produced widespread rain, with heavy falls in places, and very rough weather. Barometers were particularly low between the 13th and 19th, and thereafter recovered only gradually. Boistrous westerly gales did some damage at Auckland on the 15th. On the 19th some of the streets of Greymouth were flooded owing to a local downpour The depression of the 26th had a cyclonic centre in its northern portion, the track of which passed close to the southern border of Nelson Province. Except for parts of the eastern districts of the South Island, heavy rain was almost general on this date. Severe floods occurred in the Hutt Valley and at Otaki.

On the 28th a very intense anticyclone moved on to the Dominion, barometers rising to over 30·5 in. The weather from then till the end of the month was controlled by this anticyclone and was a marked improvement on that of the preceding fortnight.

RAINFALL FOR NOVEMBER, 1930, AT REPRESENTATIVE STATIONS.

No	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	1·83	17	0·50	3·10
2	Russell	1·52	10	0·50	2·41
3	Whangarei	1·40	10	0·30	2·97
4	Auckland	3·11	21	0·54	3·33
5	Hamilton	4·09	14	1·18	4·10
5A	Rotorua	4·10	14	0·68	4·17
6	Kawhia	4·14	17	0·92	4·54
7	New Plymouth	5·50	21	0·88	4·73
8	Riversdale, Inglewood ..	11·31	22	2·80	9·12
9	Whangamomona	..	..	..	7·38
10	Eltham	4·03	18	0·90	4·48
11	Tairua	1·52	12	0·32	4·01
12	Tauranga	2·86	16	0·63	3·36
13	Maraehako Station, Opotiki	5·20	16	1·06	3·13
14	Gisborne	1·21	7	0·50	3·00
15	Taupo	3·09	14	0·84	3·48
16	Napier	1·39	8	0·65	2·50
17	Hastings	2·27	7	1·00	1·75
18	Taihape	4·78	17	0·85	3·55
19	Masterton	2·12	10	0·87	2·79
20	Patea	5·48	19	1·27	3·99
21	Wanganui	3·50	15	0·53	3·28
22	Foxton	4·23	19	1·00	3·26
23	Wellington (Karori Reservoir)	4·14	13	1·56	3·21
	South Island.				
24	Westport	11·47	25	2·11	8·85
25	Greymouth	10·89	25	1·40	9·01
26	Hokitika	12·03	23	2·06	10·80
27	Ross	14·46	21	2·64	14·15
28	Arthur's Pass	..	..	..	16·34
29	Okuru	15·23	18	2·87	13·03
30	Bainham	15·57	21	2·71	13·51
31	Nelson	3·19	14	0·63	3·03
32	Spring Creek	2·89	11	0·65	2·50
33	Tophouse	6·08	20	1·08	6·72
34	Hanmer Springs	3·93	11	1·09	3·07
35	Highfield, Waiau	2·94	7	0·92	2·56
36	Gore Bay	1·80	6	0·88	2·22
37	Christchurch	1·18	9	0·57	1·95
38	Timaru	1·50	12	0·42	1·95
39	Lambrook Station, Fairlie ..	1·54	6	0·64	2·03
40	Benmore Station, Clearburn	2·26	13	0·77	2·10
41	Oamaru	1·81	11	0·68	1·93
42	Queenstown	3·88	14	1·06	2·74
43	Clyde	1·89	11	0·61	1·35
44	Dunedin	4·82	20	0·78	3·27
45	Wendon	4·96	17	0·90	2·77
46	Gore	..	..	..	3·23
47	Invercargill	6·68	25	1·30	4·37
48	Puysegur Point	9·22	25	1·18	8·28
49	Half-moon Bay	6·56	21	1·03	5·81

—*Edward Kidson, Director of Meteorological Services, Wellington, 5/12/30.*

LIVE-STOCK IN NEW ZEALAND, 1930.

Unless otherwise specified, the enumeration is at 31st January.

Land District.	Horses.	Asses and Mules.	Cattle (including Dairy Cows).	Dairy Cows.		Number of Sheep shorn, 1929–30.	Number of Lambs tailed, 1929–30.	Sheep (including Lambs) as at 30th April, 1930.	Pigs.	Goats.	
				In Milk.	Dry.					Angora.	Other.
North Auckland ..	31,312	67	541,424	237,022	7,667	1,045,170	467,459	1,225,114	75,746	796	3,133
Auckland	45,124	9	876,171	409,506	12,025	1,492,546	863,713	1,655,813	156,648	2,398	6,767
Gisborne	18,315	48	344,564	36,907	2,884	2,994,460	1,319,139	3,241,907	10,183	1,092	3,476
Hawke's Bay ..	15,098	..	239,846	49,742	2,483	3,060,524	1,632,119	3,304,016	15,231	2,348	6,692
Taranaki	18,984	1	400,439	209,163	7,091	926,655	477,115	994,049	51,805	135	4,461
Wellington	39,090	28	710,450	199,423	7,794	5,607,591	3,057,632	6,207,360	70,682	575	786
Nelson	6,437	1	67,521	26,436	1,472	395,934	176,029	478,117	13,787	1,274	629
Marlborough	6,687	9	46,430	15,273	828	1,053,683	474,331	1,168,060	6,333	728	3,040
Westland	2,148	..	42,999	12,082	740	71,097	51,913	88,095	6,143	1	396
Canterbury	57,312	42	185,185	72,867	2,089	4,779,740	3,023,573	5,751,940	42,577	148	67
Otago	32,006	5	137,553	51,335	2,873	3,451,991	1,891,144	4,074,223	18,104	19	159
Southland	24,682	8	173,086	69,116	3,503	2,120,019	1,452,532	2,652,593	11,553	..	7
Dominion totals ..	297,195	218	3,765,668	1,388,872	51,449	26,999,410	14,887,599	30,841,287	487,793	9,514	29,613
Totals 1929 (or 1928–29)	298,986	237	3,445,790	1,291,204	79,859	25,295,560	13,855,958	29,051,382	556,732	8,590	25,636

—*Census and Statistics Office.*

ESTIMATES OF THE SEASON'S LAMBING.

FOLLOWING are estimates of the current season's lambing in New Zealand computed from estimated average percentages furnished by Inspectors of Stock. Corresponding figures for the five previous years, together with the actual number of lambs tailed therein, are also given for comparison.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
		NORTH ISLAND.		
1930 ..	9,312,461	83·19	7,747,274	
1929 ..	8,820,536	87·56	7,723,523	7,817,177
1928 ..	8,211,878	84·61	6,948,380	7,286,284
1927 ..	7,905,432	87·28	6,899,861	7,114,057
1926 ..	7,503,200	84·35	6,329,338	6,459,775
1925 ..	7,463,735	85·64	6,391,812	6,345,218
		SOUTH ISLAND.		
1930 ..	8,251,714	84·43	6,967,041	..
1929 ..	7,787,619	89·87	6,998,691	7,070,422
1928 ..	7,322,173	87·74	6,424,887	6,569,674
1927 ..	6,926,298	86·17	5,968,979	6,064,915
1926 ..	6,445,052	84·79	5,465,361	5,609,906
1925 ..	6,251,488	78·61	4,914,046	5,090,562
		DOMINION.		
1930 ..	17,564,175	83·77	14,714,315	..
1929 ..	16,608,155	88·65	14,722,214	14,887,599
1928 ..	15,534,051	86·09	13,373,267	13,855,958
1927 ..	14,831,730	86·76	12,868,840	13,178,972
1926 ..	13,948,252	84·57	11,794,699	12,069,681
1925 ..	13,715,223	82·43	11,305,858	11,435,780

District Estimates.

The following table gives estimates of the current (1930) season's lambing for the several sheep districts :—

Sheep District.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.
Auckland..	1,865,690	89·26	1,665,441
Napier-Gisborne	3,858,525	74 97	2,891,938
Wellington - West Coast ..	3,588,246	88·89	3,189,895
Marlborough-Nelson-Westland	809,400	71·68	580,235
Canterbury-Kaikoura ..	3,663,071	86·49	3,168,226
Otago (including Southland)	3,779,243	85·16	3,218,580
Dominion	17,564,175	83·77	14,714,315

—*Live-stock Division*

Exportation of Stud Stock.—During the year ended 31st March, 1930, the following stud stock was exported : Sheep, 3,358 ; cattle, 128 ; swine, 28 ; horses (draught), 9. In addition to these draught-horses several shipments of trotters and thoroughbreds were made to Australia for racing purposes, but many of these returned at the conclusion of their engagements.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

HEMLOCK AND ITS CONTROL ON THE FARM.

J. A. B., Waikaia :—

I write to ask if you can give me any advice as to how to deal with the hemlock-plant On a farm I have here (formerly used for dairying) there is a patch of this weed (½ acre or more), which is spreading rapidly, and although it has during the last year been carefully scythed two or three times, yet it seems to be growing more vigorously than ever My neighbour, a dairy-farmer, says he believes he has lost three or four cows from it, and also thinks it may have been the cause of the death of one or two of his horses. I also have lost two draught horses within the last eighteen months : one was found resting in a hard-bottomed creek—apparently paralysed and unable to rise, and had to be shot, the other was found dead (showing no signs of struggle). These horses had some time previously access to where the hemlock was growing. I have no evidence of their eating it, but I have wondered if the apparent paralysis in the one might not have been due to the weed. Would the chlorates you now recommend for ragwort be effective with the hemlock ?

The Live-stock Division :—

The poisonous property of hemlock has been well known from time immemorial, but stock, as a rule, do not eat the plant; it is offensive to them owing to its extremely unpleasant odour. When animals are definitely poisoned by the plant the progress of symptoms is rapid, and death would soon take place. There is generally greatly accelerated breathing, muscular trembling, difficulty in walking, some paralysis, and a low temperature. With regard to the use of sodium chlorate being effective against hemlock, some experiments have recently been conducted in the North Island. The results are to some extent inconclusive, but it would appear that (1) the solution will require to be stronger than that used on ragwort; (2) that it is more effective on old growth than on new; and (3) that more than one spraying is necessary to prevent further growth. In your district, so far as poisoning of stock is concerned, one must not lose sight of the probability of ragwort poisoning, the symptoms of which are dopiness, staggering gait, increasing debility, and subsequently blindness; but these are progressive over a much longer period—often two or three months.

GRASS-SEED MIXTURES FOR BURNS.

F. G. Lewis, Eketahuna :—

I shall be obliged if you will supply me with a list of grass-seeds and quantities suitable for a bush-burn on a good heavy clay soil, part of which is a hilly face facing north-east and the rest being flat. The ground has been heavily timbered with matai, rimu, white-pine, and tawa chiefly. Secondly, I would like a suitable seed mixture for a hard clay face facing west; it has never had heavy timber on it, but is being cleared of scrub at the present time.

The Fields Division :—

A mixture suggested for your heavy clay flat is as follows : Italian rye-grass, 4 lb.; Hawke's Bay perennial rye-grass, 16 lb ; Akaroa cocksfoot, 6 lb.; timothy, 2 lb.; crested dogstail, 2 lb.; cowgrass, 5 lb.; white clover, 2 lb.: total, 37 lb. per acre. For the clay face facing north-east the following should be suitable: Italian rye-grass, 4 lb.; Hawke's Bay perennial rye-grass, 10 lb.; Akaroa cocksfoot, 8 lb.; crested dogstail, 3 lb.; Danthonia pilosa, 3 lb.; brown-top, 1 lb.; white clover, 2 lb.: total, 31 lb. per acre. In the case of the hard clay face facing west, where you are at present clearing scrub, and which no doubt you will be surface-sowing on the burn, the following is suggested : Hawke's Bay perennial rye-grass,

12 lb., Akaroa cocksfoot, 8 lb; crested dogstail, 3 lb; Poa pratensis, 1 lb; brown-top, 1 lb; Danthonia pilosa, 3 lb.; white clover, 2 lb.: total, 30 lb. per acre. As you are in the vicinity of lime-works, if it is not too costly, you would be well advised to lime the heavy clay to which the first mixture refers, and also to assist the young pasture with a phosphatic manure

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COVER-CROP MANURING AND WEED-CONTROL IN ORCHARD.

"SUBSCRIBER," Auckland:—

Would basic slag be sufficiently quick-acting to sow with a blue-lupin cover-crop in autumn in an orchard? What quantity would be necessary, if it is suitable for the purpose? Owing to the use of superphosphate as a fertilizer in the orchard for the past two years, it is not desired to apply more for the lupins. The soil is gum land, varying from light loam to heavy clay. What is the best method of eradication or control in a 10-acre orchard of strong annual growths of fern, paspalum (which is spreading rapidly), and blackberries?

The Horticulture Division:—

Basic-slag is slow-acting, but the lupin crop takes a long time to develop, and would very possibly benefit from the manure applied. Acid superphosphate is to a great extent wasted on orchards in gum land, unless a dressing of lime is also given. When sowing a green cover-crop in the autumn 2 cwt. to 5 cwt. of a phosphatic manure per acre is applied, according to the conditions In your case the amount would probably be rather large, but depending on the amounts and results of the previous use of superphosphate. Further advice should be obtained from the district Orchard Instructor. The growth of fern, paspalum, and blackberries should not have any chance of becoming troublesome in a 10-acre orchard under ordinary management. A cover-crop to smother the weeds in autumn, and spring ploughing, with summer cultivation to follow, is the most effective method of controlling weeds that could be devised; but it should be done thoroughly.

AUSTRALIAN CHERRIES.

G. MILLSOM, Blenheim:—

It has been stated in several papers recently that old cherry-trees are being regrafted with new Australian varieties. Further, it is stated that the Australian cherries are better appreciated by the public. Can you tell me the names of these varieties, and the order of bearing.

The Horticulture Division:—

The "Australian cherries" you mention as being popular are the larger mid-season varieties Florence and Black St. Margaret. A popular late variety there is Noble, and of the early varieties Early Lyons and Eagle Seeding are most i· favour.

SODIUM CHLORATE FOR RUSHES AND CUTTY-GRASS.

"SUBSCRIBER," Napier:—

Will you kindly inform me whether sodium chlorate would be a suitable spray for killing rushes and cutty-grass. If so, in what proportion for mixing. Is it injurious to sheep or cattle?

The Fields Division:—

Experiments are at present being carried out with sodium chlorate as a means of killing rushes, but are not yet finalized. So far a solution of from 2½ to 3 per cent. appears to be having a favourable result We have not yet tried sodium chlorate on cutty-grass. This chemical is not injurious to sheep or cattle when sprayed on vegatation in low-percentage solutions.

IMPERIAL AGRICULTURAL BUREAUX AT WORK.

ALL the eight Imperial agricultural bureaux, set up under Imperial control to act as clearing-houses of information for agricultural science, have started work during the past year and are now in full working-order, states the first annual report of the Executive Council, recently issued.

The bureaux are financed out of a common fund, to which England and Wales, Scotland, Northern Ireland, Canada, Australia, New Zealand, South Africa, the Irish Free State, India, Southern Rhodesia, and the Crown colonies contribute. These countries are represented on the Executive Council in London, which is, in fact, a really Imperial secretariat working under the control of nearly all the Empire Governments The Chairman of the Executive Council is Sir Robert Greig, and the Secretary Sir David Chadwick.

Each bureau is located at a leading research centre in the United Kingdom, and the Director of the institution is in each case Director of the Bureau. The branches of science dealt with are as follows . Soil science (Rothamsted), animal nutrition (Aberdeen), animal health (Weybridge), animal genetics (Edinburgh), animal parasitology (St. Albans), plant genetics (one for crops at Cambridge and one for herbage plants at Aberystwyth), and fruit-production (East Malling).

The functions of the eight bureaux are to collect all information published in any part of the world dealing with their particular sciences This they translate, catalogue, summarize, and pass on to officers in all parts of the Empire to whom it is of interest. They are also intended to keep kindred workers in different parts of the Empire in touch with each other, and to advise and help overseas officers who are in the United Kingdom on "study leave." They do not undertake research work themselves, but pass on problems to the right centre.

Direct contacts between bureaux officers and oversea workers are fostered, and to this end an officer who has either received part of his early training or has served for some time in some part of the Empire overseas has been selected in almost every case for the post of chief officer under the Director. Official correspondents resident overseas have been nominated during the past year and are now in consultation with the bureaux.

A list of the New Zealand correspondents and their respective bureaux was published in the *Journal* for November, 1929, page 361.

FORTHCOMING AGRICULTURAL SHOWS.

THE following show-dates have been notified by agricultural and pastoral associations :—

Helensville A. and P. Association : Helensville, 29th January, 1931.
Feilding A. and P. Association : Feilding, 3rd and 4th February.
Dannevirke A. and P. Association : Dannevirke, 10th and 11th February.
Masterton A. and P. Association : Solway, 17th and 18th February.
Te Awamutu A. and P. Association : Te Awamutu, 18th February.
Marton A. and P. Association : Marton, 25th February.
Auckland A. and P. Association : Auckland, 26th, 27th, and 28th February.
Katikati A. and P. Association : Katikati, 3rd March.
Taranaki Agricultural Association : New Plymouth, 4th and 5th March.
Waikato Central Agricultural Association : Cambridge, 4th and 5th March.
King Country Central A. and P. Association : Te Kuiti, 12th March.
Mayfield A. and P. Association : Mayfield, 14th March.
Hawke's Bay A. and P. Society : Tomoana (Autumn Show), 18th March.
Methven A. and P. Association : Methven, 28th March.
Oxford A. and P. Association : Oxford, 2nd April.

Foreign Butter-containers.—The Inspector of New Zealand Dairy-produce in London advises that lately Siberia, Poland, and Estonia have been shipping butter in oblong boxes of the New Zealand type.